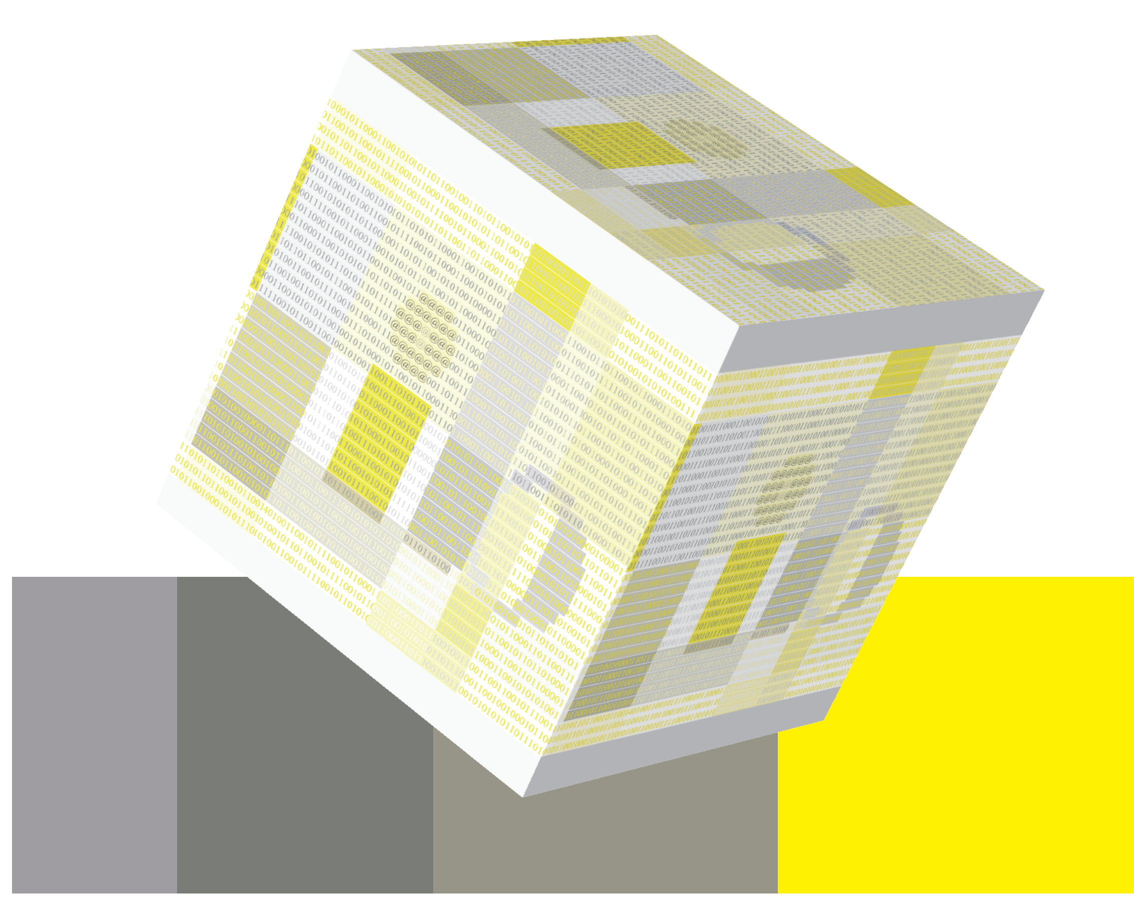
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教育資料與圖書館學

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教育資料與圖書館學 JOURNAL OF EDUCATIONAL MEDIA & LIBRARY SCIENCES Vol. 56, No.1, 2019



淡江大學出版中心



教育資料與圖書館學，始於1970年3月創刊之**教育資料科學月刊**，其間於1980年9月更名為**教育資料科學**，並改以季刊發行。自1982年9月起易今名。另自2016年11月起，改以一年出版三期（3月、7月、11月）。現由淡江大學出版中心出版，淡江大學資訊與圖書館學系和覺生紀念圖書館合作策劃編輯。本刊為國際學術期刊，2008年獲國科會學術期刊評比為第一級，2015年獲科技部人文社會科學研究中心評定為教育學門專業類A級期刊。並廣為海內外知名資料庫所收錄(如下英文所列)。

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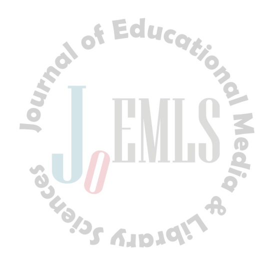
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教育資料與圖書館學

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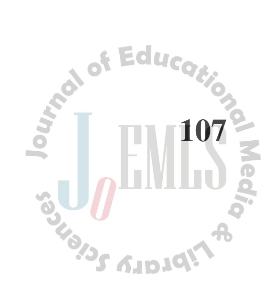
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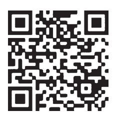
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EDITORIAL

We as the Taiwan Vanguard of Journal with Open Peer Review

In the former Editorial of Issue 1, Volume 55 (2018), we have proposed three questions regarding the development of open peer review (OPR). What is the feasibility of applying OPR to journals in the field of social sciences, including library and information science? Do vendors of academic information value-added systems or databases have the willingness to get involved in the development and services of OPR systems? Are scholars in humanities and social sciences willing to change habits and break with tradition, and accept new challenges of OPR?

The OPR has not yet been given a unified name and a universally identical definition. OPR has also been termed as "public peer review", "transparent peer review", and "advanced open peer review". In terms of common features, OPR are termed as "signed review", "disclosed review", "transparent review", "editor-mediated review", and "crowd-sourced review". For another three attached features, OPR are also called "synchronous review", "pre-publication review", and even "post-publication review".[1] These features above indicate the innovative aspect of OPR in breaking with traditional modes, especially the new mode of "crowd-sourced review", suggesting that chief editors of journals can recruit numerous scholars and experts for undertaking the task of manuscript review, through a network platform that incorporates new media technologies and equips with a real-time, interactive and transparent mode of being able to verify all OPR tasks. However, not all of the features mentioned above are necessary to be included in one OPR system. The implementation of OPR varies with different management modes of journals. Each feature is allowed with a certain degree of creativity, and the implementation of OPR is allowed with differences of depths. When to open (timeliness) and how to open (democratic authorization and technical conditions)? These questions are for all of scholars and journal editors to contemplate. Solutions to problems should respond to calls for ideal and practical considerations, and people who take charge should select or design the most appropriate management mode for their own journals.

The general requirements for the OPR system of journals are described below.

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[1] Emily Ford, "Defining and Characterizing Open Peer Review: A Review of the Literature," *Journal of Scholarly Publishing* 44, 4 (2013): 311-326. See also the information at https://pdxscholar.library.pdx. edu/cgi/viewcontent.cgi?article=1000&context=ulib_fac.

1. The identity information of peer reviewers should be open, contrary to traditional double-blind or single-blind modes that hide identities of peer reviewers.

2. No matter it is a pre-publication or post-publication review mode, after the review procedure is terminated, contents of peer reviewers' opinions should be open together with published manuscripts.

3. The open access (OA) mode should be adopted, and articles should be published online for interested readers to add comments to articles. However, contents of readers' comments are not necessary to be regarded as the basis of formal reviews of academic contents of manuscripts. It is to provide a channel for authors and readers to communicate with each other.

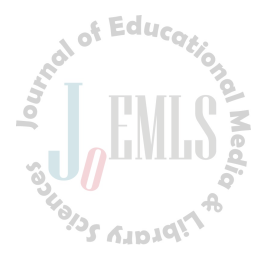
It is worth noting that the three requirements mentioned above could be independently used, or applied with different combinations. No matter what the combination is, in a broad sense, it could be termed as "Open Peer Review". In addition, from the perspective of epoch revolution, OPR system is indeed highly relevant to the open access mode, but even profit-oriented journals with a non-open-access mode could possibly adopt partial features of OPR and develop their publishing strategies. In other words, the point of OPR lies in the open and blind aspects, not in presenting confronting thoughts. Any design mechanism that respects the free wills of authors and reviewers, makes the review process open and transparent, promotes positive academic talks with assistances of technologies and media, guards academic quality and takes responsibilities of academic communication, could be regarded as an open-minded and trust-worthy OPR system.

Our *JoEMLS* takes a positive and serious stance toward the development of OPR in future's academic journal publishing in Taiwan, and we will certainly be in the vanguard of the OPR trend. In the future if scholars and chief-editors of journals could apply various added values of open peer review, such as Digital Object Identifier (ODI), Open Researcher and Contributor ID (ORCID), and Altmetrics, we have good reasons to believe the academic field in Taiwan is certainly to generate or accept the development and application of this kind of new platforms. No matter from the literature review of domestic and overseas applications of OPR platforms, or from analysis of 2018 surveys conducted by *JoEMLS* team that sent to more than one hundred scholars who ever reviewed manuscripts in Chinese for *JoEMLS*, and results of interviews with chief-editors of journals in library and information science field in Taiwan, we obtained similar findings. In the premise of respecting the willingness of relevant authorities, it is expected and feasible to design OPR solutions that are with characteristics, human

nature, and expediency. There obviously has no fixed modes of OPR systems, and we found plenty of innovative measures. With the spirit of innovation, revolution and experiments, our journal will not hesitate to continually promote and improve application modes of OPR, and usher journals of humanities and social sciences in Taiwan toward a new epoch of OPR.

In this issue (Issue 1, Volume 56), thirteen manuscripts have been reviewed, and four of them are accepted and published, with a rejection rate of 69.2%. The articles published in this issue include "The Maturity Assessment of the Recent Open Data Development in the Context of Taiwan E-Government" by Tung-Mou Yang and Yi-Jung Wu, "Does the Learning of Computational Thinking Concepts Interact with the Practice of Digital Curation in Children? A Preliminary Case Study" by Chun-Hao Chang, "An Application of ePUB3 eBooks to the Design and Teaching of Flipped 'Applied Writing' Courses: An Example of 'Abstract Writing' " by Tina Pingting Tsai, Chingsheng Hsu, and Jyhjong Lin, and "Quality Discussion and High-Level Comprehension: An Analysis of Taiwanese College Students" by Hsiao-Ling Hsu, Hao-Jan Howard Chen, and Wei-Tin Lin. There are many good articles left out. There are also many wonderful contents of academic criticism, reflections and debates that are not able to be shared. Some of these non-published academic publishing processes and debates are not less thought-provoking than published contents. If not with the clever application of OPR system, these wonderful insights can be only left in the memories of involved parties and archives of chief-editors of journals. We thank all of the authors who submitted manuscripts. No matter the manuscript is accepted or rejected, each author is a respectable scholar.

Jeong-Yeou Chiu
JoEMLS Chief Editor



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編者言

期刊「開放式同儕評閱」從我們做起

本刊曾在2018年55卷1期「編者言」，特別就期刊「開放式同儕評閱」（Open Peer Review，以下簡稱OPR）之發展問題，有以下三提問：未來OPR應用在人文社會學（含圖書資訊學）期刊領域的可行性如何？台灣的學術資訊加值廠商或資料庫商是否有意願涉入OPR系統之開發與服務？以及人文社會科學學者是否願意改變習性並突破傳統，接受OPR的創新挑戰？

OPR制度發展至今，其名稱並未獲明確統一，甚至其定義也有所差異。通常OPR也被稱為「公開的同儕評閱」（Public Peer Review）、「透明的同儕評閱」（Transparent Peer Review）、「進階的同儕評閱」（Advanced Open Peer Review）。而就其共通特性而言，則展現在「評閱署名」（signed review）、「評閱揭露」（disclosed review）、「評閱透明」（transparent review）、「主編斡旋」（editor-mediated review）、「群眾外包」（crowdsourced review）；以及另三項附帶特質，即「評閱同步」（synchronous review）、「出版前評閱」（pre-publication review）和「出版後評閱」（post-publication review）上。[1] 這些特質更進一步清楚說明了「開放同儕評閱」突破傳統模式的新作為，尤其「群眾外包」的精神更是一種新的運作模式，意味著期刊主編利用網路平台將稿件評閱工作，以整合新媒體科技、即時、互動、公開透明的模式與可以驗證的任務，召集大量學者專家志願執行。然而，上述特質並不一定要全數具備，所謂的OPR模式的執行因各個期刊經營機構而異，並且每項特質亦可另有巧思，貫徹深淺程度也容有不同，何時「開放」（時效性）？如何「開放」（民主授權、技術性）？這些問題乃是留待所有學者或期刊編務工作者思考，而其解決方法都可兼具理想與務實之需，由各主事者選擇或設計出最適合自己期刊的經營模式。

一般而言，期刊OPR制度要件，主要認定在於：

㈠公開的評閱者身份資訊，不再是採傳統雙盲或單盲模式將評閱者身份隱匿；

㈡不論「出版前」或「出版後」之評閱模式，在終結評閱程序後，評閱者意見內容將與受刊登稿件同時公開；

㈢文章採用開放取用（Open Access; OA）模式將文章公諸網路，對於文章主題有興趣的讀者都能對文章加入評論。但讀者評論內容，並非必然成為文章學術內容正式評閱把關之依據，而係作為文章作者與讀者對話交流之模式。

[1] Emily Ford, “Defining and Characterizing Open Peer Review: A Review of the Literature,” *Journal of Scholarly Publishing* 44, 4 (2013): 311-326. 同份資料亦可得自https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1000&context=ulib_fac.

值得留意的是：前述三項要件可各自獨立、各種相排列組合應用，不論組合如何，現時在廣義應用上皆足以稱作「開放式同儕評閱」。此外，從時代演進的觀點而言，OPR制度的確與OA關係密切，但即使營利性的「非OA」期刊亦有可能採取OPR之部分特點而發展其出版策略。易言之，OPR精神在所謂的「開放」（open）與「盲審」（blind）議題並非呈現對立的概念，凡能落實多多尊重作者與評閱者的自由意願，而將評閱流程「公開且透明」化，在科技與媒體的協助下，促進良性的學術對話，並為學術品質把關以及善盡學術傳播責任的設計機制，都足堪稱作開明、信實的OPR制度。

本刊教育資料與圖書館學（*JoEMLS*）非常正面與嚴肅地看待OPR未來在台灣學術期刊出版界的發展。也勢必從自身做起。未來若在學者與主編對於OPR可以形成之各種附加價值，例如：DOI、ORCID、Altmetrics等工具應用下，我們絕對有理由相信，台灣學界必定能產生或接受這類新平台的開發及應用。不論從OPR文獻的爬梳來掌握各國外知名OPR平台的應用；或是我們曾經在2018年針對曾為*JoEMLS*擔任中文審稿者的百多位學者發出問卷，並由訪談台灣圖資學主要期刊主編的訪談結果，都得到近似的答案：在尊重相關權益人「意願」的前提下，借助科技之賜、以創新應用的精神與作為，設計出具特色、人性的、權宜的OPR解決方案仍將是可期、可為的。OPR制度迄今顯然也並無一定的「模式」，我們所發現的卻是更多的「創新」作為。而本刊也將毫無遲疑地以創新、改革、試驗的精神，持續推動並改善OPR的應用模式，引領台灣人文社會學期刊邁向新的OPR時代。

語末，本刊此卷期（56卷1期）共計處理完成13篇稿件，僅接受其中4篇文章之刊登，退稿率來到百分之69.2。本卷期刊登大作包括：楊東謀、吳怡融的「台灣政府開放資料推行之近況調查與探討」、Chun-Hao Chang發表“Does the Learning of Computational Thinking Concepts Interact with the Practice of Digital Curation in Children? A Preliminary Case Study”；還有蔡娉婷、許慶昇、林至中三位發表的「應用ePUB3電子書於翻轉式寫作課程設計與教學實務：以摘要寫作為例」，以及Hsiao-Ling Hsu、Hao-Jan Howard Chen、Wei-Tin Lin的大作“Quality Discussion and High-Level Comprehension: An Analysis of Taiwanese College Students”。除了這四篇大作之外，更有許多的遺珠之憾；也有許多來自作者與評閱者雙方精彩的學術批判、反思、答辯內容，卻無緣分享於眾。這些無法公開的學術發表過程與辯證，有時甚至不亞於發表內容之發人深省，若無OPR制度設計的巧妙運用，就只能塵封於當事人的記憶與期刊主編的歷史檔案裡。我們非常感謝所有的賜稿者，無論投稿成功或失敗，大家都是可敬的學者。

邱　炯友
教育資料與圖書館學主編


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研究論文

台灣政府開放資料推行之近況調查與探討

楊東謀[a*] 吳怡融[b]

摘要

近來年開放資料已成為國際間政府施政的重要趨勢，以協助達成政府透明化與促進公眾參與。我國中央與地方政府亦已紛紛投入人力與資源以推行開放資料政策。然各機關的資訊環境與相關準備度有所不同，而於開放資料的推行與實作程度不一。因此，本研究引用文獻所提出的開放資料成熟度架構，用以發展問卷題項，以我國中央與地方政府機關作為研究場域，用以評估其政府開放資料的推行現況，以嘗試了解整體機關實行的成熟度為何，並探討不同層級機關的推行能力與投入程度上是否有差異存在。本研究根據研究發現進行討論與提出建議，在實務上可提供政府單位於後續相關政策實行與資源分配之參考，用以協助後續政府開放資料的政策規劃與推行。

關鍵詞： 開放政府，開放資料，資料開放，評估，電子化政府

前　言

在當今的電子化政府文獻中，跨政府機關的資訊分享乃為一重要之研究課題，相關文獻指出，公部門間的資訊分享可協助政府機關的運作更有效率，以提供大眾更為整合、精準與創新的服務（Klievink & Janssen, 2009; Layne & Lee, 2001; Yang & Wu, 2015）。然而，亦有文獻指出，跨機關的資訊分享並不僅侷限在公部門範疇，在開放政府的概念之下，政府機關所持有的資訊與資料亦可開放給予公眾使用，跨域的範疇可延伸到私部門企業、非營利組織與公民個人等（Yang, Pardo, & Wu, 2014; Yang, Zheng, & Pardo, 2012），此即呼應到政府開放資料（open government data）的概念。政府開放資料為近年來受到相當重視的議題，已蔚為一股國際潮流，成為國內外政府機關施政的重要方針之一。政府開

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放資料的推行為開放政府之重要基石，透過公部門的資料開放可達到政府透明化與公眾參與的目標，並可鼓勵公眾運用政府資料進行創新應用，進而促進經濟與新創產業之發展（Janssen, Charalabidis, & Zuiderwijk, 2012; Kassen, 2013）。現階段，我國中央與地方政府機關已紛紛投入相關人力與資源以推行開放資料，行政院亦藉由「資料開放民眾與企業運用」、「以免費為原則、收費為例外」、「資料大量、自動化而有系統的釋放與交換」三步驟，並配合「主動開放，民生優先」、「制定開放資料規範」、「推動共用平台」、「示範宣導及服務推廣」四大策略以推動政府開放資料工作，以期透過政府開放資料，促成跨機關與民間協同合作與服務創新（陳怡君，2013）。然肇因於不同機關在法令規範、組織與資訊環境等因素的差異之下，個別機關於開放資料政策執行上的能力有所差異，也導致開放資料的進程不一，如開放資料集的數量多寡、是否採用應用程式介面開放、是否有提供詮釋資料等皆有所差異（羅晉、楊東謀、項靖、王惠茹，2013）。此外，開放資料的政府機關與資料使用者之間是否存有溝通管道等亦為重要的影響因素，諸如機關是否有鼓勵公眾使用資料、是否有建立機制以回應資料使用者的問題等。

因此，本研究是以我國政府開放資料的推行現況作為研究場域，嘗試探討以下的研究問題：我國政府機關於開放資料的相關實行能力與投入程度之情況為何？我國不同層級的政府機關（中央機關、六都機關與非六都地方機關）於開放資料的推行能力與投入程度上是否有差異存在？本研究採用相關文獻所建立之概念框架以進行調查，分別從制度與法令面向、技術與資料面向，和公眾互動與合作面向以進行探索。本研究結果可作為我國政府於開放資料政策發展的參考，以加強現有開放資料的政策擬定與推行方式，以期適當調配有限的資源，以更為鼓勵與協助機關於開放資料的參與和實行。本文將於第二節先進行開放資料相關的文獻探討，說明開放資料的概念與介紹我國開放資料的發展歷程，並討論開放資料推行的影響因素和相關評估架構。第三節為研究方法，用以說明問卷施測對象、資料蒐集與分析的方式。第四節與第五節分別為研究發現與討論，就問卷分析所得之實證資料進行說明與探討。最末節為結論，分別就研究貢獻、現行研究限制與未來研究方向提出說明。

二、文獻探討

㈠ 開放資料的概念

政府身為一國最大的資料收集者、產製者與分析者，而政府資料主要是應用於公部門機關之日常運作，然在政策與相關制度配套之下，倘能將政府資料提供公眾使用，除可提升民主價值和增進公眾的公共事務參與之外（Ruijer, Grimmelikhuijsen, & Meijer, 2017），亦可透過公眾的集合智慧，藉由取得、分

析與整合不同態樣的政府資料，以協助政府機關解決所面臨的挑戰，並進而發展創新應用與促進新創產業發展等以提升整體公共價值（陳舜伶、林珈宏、莊庭瑞，2013；Janssen et al., 2012; Jetzek, Avital, & Bjorn-Andersen, 2014）。細部言之，開放資料是政府機關將其在業務執行上所產製或蒐集的原始資料數位化，且經過整理分類以及內容結構化之後釋出，讓公眾、非營利組織、企業等透過網際網路搜尋，如經由政府資料開放平台等，由網路下載或應用程式介面介接，以取得所需或感興趣的資料集，再分析使用之。而資料集之間亦可混搭使用，進而產出不同面向的資料價值。透過政府開放資料的推行，預期將讓政府資料的使用更為多元，讓公眾等皆能參與協力，在不同的領域如急難救助、高等教育、公共衛生與醫療照護等，政府機關已經與公眾有許多公私協力的開放資料應用案例（李亦君、許一珍、林仁智、蘇郁惟，2016；林仁智、李亦君、黃俊豪，2014；韓佩軒、李昇暾、許明暉、呂宗學，2016；Kassen, 2013; Tinati, Carr, Halford, & Pope, 2012）。

㈡我國開放資料的發展歷程

國際間開放資料的推動現況已日益成熟，我國政府近年來也積極擬定相關推動計劃，如建立開放資料諮詢機制、完備開放環境建置、舉辦相關應用競賽以鼓勵公眾參與，並尋求與民間組織企業等合作以逐步推行之，期能達到政務透明、公眾參與以及協同合作之資料開放三大目標，其亦為開放政府之三大原則（吳肇銘，2012；宋餘俠、李國田，2012；張家生，2012；黃心怡、蘇彩足、蕭乃沂，2016）。

我國自2005年推動政府公開資訊法後，進一步達到政府資訊透明化的目標，以保障民眾於知的權利（陳怡君，2013；黃心怡等，2016）。然政府公開資訊法著重於機關應該主動公開十大類資訊，此十大類政府資訊是以文書、法規、預算、組織資訊，與會議記錄等為主，與政府資料開放所強調的資料集並不盡相同（項靖、楊東謀、羅晉，2013）。2009年起，我國資料開放的發展也漸趨蓬勃，發展之方式與歐美國家的推行歷程相近，主要是先由民間公民團體發起推動，嘗試運用政府資料在多個領域以進行創新加值（蕭景燈，2012）。我國2011年之「第四階段電子化政府計畫」亦納入資料加值應用的精神（陳怡君，2013）。同年9月，臺北市政府開放資料平台（data.taipei）正式上線，整合市政府各局處之開放資料於單一入口網站（張家生，2012）。2011年年底，中央研究院台灣創用CC計畫亦舉辦「開放政府資料：現況、願景、策略」座談會，探討開放資料的推行與實施經驗（蕭景燈，2012）。

2012年11月，行政院第3322次院會決議通過「政府資料開放推動策略建議」。此決議為我國推動政府開放資料計畫的重要里程碑；行政院研究發展委員會（現為國家發展委員會）也於2013年初訂定行政院及所屬各級機關政府資料

開放作業原則，給予我國政府機關參考以推行開放資料政策（陳怡君，2013）。在地方政府方面，新北市、台中市、台南市、高雄市及桃園市等地方政府也陸續建置資料開放平台；在中央部會方面，包括農業委員會、文化部，和環境保護署等也分別將其平台上線。2013年4月，我國中央機關之「政府資料開放平台」（data.gov.tw）網站亦正式上線營運（黃心怡等，2016）。除政府機關以外，台北市電腦商業同業公會結合產業於2013年9月成立「Open Data聯盟」，成員包含產學研究者、社群以及民眾代表。該聯盟是以促進開放資料之產業運用與發展為宗旨，亦積極推動開放資料之國際交流與合作，以提供政府作為施政參考（蘇文彬，2013）。

後續行政院將2015年定為「開放資料深化應用元年」，中央部會與二級機關各自設置政府資料開放諮詢小組，定期針對相關議題進行會議討論（莊盈志，2016）。行政院國家發展委員會並於2016年提出*創意台灣ide@Taiwan 2020政策白皮書*，並以此作為指導原則，以推動「第五階段電子化政府計畫—數位政府（106-109年）」，將持續著重於開放資料推行，期以資料治理力量以擴大公共服務的深度與廣度（國家發展委員會，2016）。此外，為推動相關政策與鼓勵公眾使用開放資料，政府機關近年來亦多次舉辦開放資料競賽，如經濟部工業局舉辦的黑客松競賽（項靖、陳曉慧、楊東謀、羅晉，2015）、2018年首辦的總統盃社會創新黑客松（中華民國總統府，2018）等。

㈢ 開放資料的影響因素

然而，政府開放資料乃是一複雜之議題，研究指出開放資料的探討涉及許多相關利害關係人，諸多面向的影響因素需要納入討論（羅晉，2015；Dawes, Vidiasova, & Parkhimovich, 2016; Gonzalez-Zapata & Heeks, 2016）。在實行開放資料的過程中，政府機關往往需要進行作業流程的調整與資訊科技技術的採用，對於機關的既有政策、流程與資訊系統等會帶來一定程度的影響與衝擊（Tinati et al., 2012）。而政府機關通常具有風險迴避的傾向，許多機關對於開放其資料是採取較為保守的態度，甚或不樂意開放其資料給與公共使用（Zuiderwijk, Janssen, Meijer, et al., 2012）。因此，開放資料文獻指出，整體開放資料生態體系建立的重要性，許多面向皆須考量，諸如相關法令規範與政策、資料的整理與釋出、資料的使用與回饋，和利害關係人之間的互動等（Attard, Orlandi, Scerri, & Auer, 2015; Dawes et al., 2016）。在整個開放資料生態體系中，尤以政府機關身為資料提供者更扮演舉足輕重的角色。因此，許多研究嘗試了解影響政府機關開放資料意願的因素，並探討這些影響因素所帶來的衝擊，主要是從科技技術面向、組織管理面向、法令政策面向，與外部環境面向等進行探討，以分析這些因素對於機關參與意願的影響，以及對於機關實際參與行為的衝擊等（賴泱州、楊東謀，2017；Conradie & Choenni, 2014; Dulong de

Rosnay & Janssen, 2014; Janssen et al., 2012; Wang & Lo, 2016; Yang, Lo, & Shiang, 2015; Yang & Wu, 2016; Zuiderwijk, Janssen, Choenni, Meijer, & Alibaks, 2012）。

在機關的開放資料發展方面，Dawes與Helbig（2010）指出，合宜的資訊政策與開放資料策略對於政府機關開放資料的推行相當重要。許多政府機關對於開放資料的推行較為陌生，可能缺乏經驗或缺少上級機關的引導方針，因而在此新業務上較無所適從（Albano & Reinhard, 2014; Conradie & Choenni, 2014）。此外，機關領導階層亦扮演相當重要的角色，領導階層對於開放資料的了解與否會影響到其對於相關政策的支持與部屬的投入程度（Yang et al., 2015）。而個別機關於開放資料的準備與推行上有時亦需要其它機關的協助與資料集提供，諸如與其它中央或地方機關進行跨域資訊分享的合作等（Yang et al., 2015）。

在法令規範方面，公務機關必須依法行事，因而在開放資料的過程需要審視機關內外部的法令規範。例如過往有一些法令規範是建置來保護政府資料的使用，因此需要了解機關的開放資料推行是否與這些既有法令規範牴觸（陳曉慧、涂家瑋，2013；戴豪君、顧振豪，2015；Yang et al., 2015; Zuiderwijk, Janssen, Choenni, et al., 2012），例如是否有限制將資料集開放給予他人或其它單位使用、是否規定需要進行資料服務的收費等。此外，某些資料集並非單純由機關本身獨自進行蒐集與產製，而是透過與他人或其它組織合作所取得，因此也需了解要開放的資料集是否有受到智慧財產權法的保護、機關是否為資料集的擁有者等（陳曉慧、涂家瑋，2013；戴豪君、顧振豪，2015；Attard, Orlandi, & Auer, 2016）。政府機關亦須考量個人資料保護法的要求，在進行資料開放前，務必需將個人隱私相關之資料移除（邱淑芬、鍾吉誠、謝淑玲，2016；陳曉慧、涂家瑋，2013）。此外，機關也需要提供明確的資料使用授權條款，以讓資料使用者擁有清楚的資料再使用依據，以鼓勵投入資料的加值應用。明確的資料授權條款亦能保護身為資料提供者的政府機關，規範說明資料提供者與資料使用者的相關權利與義務（Attard et al., 2016; Kaasenbrood, Zuiderwijk, Janssen, de Jong, & Bharosa, 2015; Magalhães & Roseira, 2016; Yang et al., 2015; Zuiderwijk, Janssen, Choenni, et al., 2012）。

而肇因於個別政府機關的資訊環境與準備度之差異，學者亦建議提供適當的資源與教育訓練給予政府機關，讓機關建立開放資料的觀念與能力，以鼓勵與協助機關業務承辦人參與實行開放資料（項靖、楊東謀、羅晉，2014；Yang et al., 2015; Yang & Wu, 2016）。在開放資料的觀念逐漸扎根下，機關也應該逐步將開放資料融入其既有的日常業務流程或新業務的開展，以利後續開放資料給予公眾使用（Yang et al., 2015）。

在資料的可得性（availability）上，機關是否儘量開放其在業務上所蒐集產製的資料集、是否對於已開放的資料集持續更新等皆會對資料的可得性帶來影響（Kaasenbrood et al., 2015; Zuiderwijk, Janssen, Choenni, et al., 2012）。而在資料

的近用性（accessibility）上，文獻指出資料的易搜尋取用與否會影響公眾使用開放資料的意願（Zuiderwijk, Janssen, Poulis, & van de Kaa, 2015）。學者建議，透過開放資料的入口網站整合使用，公眾於開放資料的取用會更為便利，即不須耗時前往個別機關或政府的開放資料平台以尋找取用資料（Yang et al., 2015）。而開放資料平台的資料集分類與目錄建置上，亦需要審慎規劃以有效協助使用者搜尋取用資料集（楊新章、林杏子、尤柏翰，2014；Zuiderwijk, Janssen, & Davis, 2014）。因此，機關於資料集的提供上應當要伴隨詳細的詮釋資料說明，諸如檔案格式、欄位名稱、產製時間等，以協助使用者了解與使用資料集（朱斌妤、曾憲立，2016；歐俐伶、楊東謀，2016；Zuiderwijk, Janssen, & Susha, 2016）。文獻中亦建議語意網（semantic web）結合開放資料的概念以發展應用鏈結開放資料（Linked Open Data），其將有助於資料集之間的串連搜尋與整合式的應用（Alvarez et al., 2012; Kaschesky & Selmi, 2013; Shadbolt et al., 2012）。

政府開放資料乃一複雜之議題，其生態體系（ecosystem）的完善與否涉及到多方利害關係人，不僅需要政府機關的投入，更需要公眾的參與以發揮開放資料的價值（Dawes et al., 2016; Hivon & Titah, 2017; Zuiderwijk et al., 2014）。然而，資料使用者端往往沒有跟上機關的開放資料步伐，因而機關需要鼓勵公眾更為積極地使用開放資料（Hellberg & Hedström, 2015; Zuiderwijk et al., 2016）。文獻指出，資料提供者與資料使用者之間的互動通常相當有限，政府機關應該持有溝通管道以協助處理公眾在取用開放資料上的過程，而非僅消極地開放些許資料集，而忽略使用者在資料取用與使用上的問題與相關回饋（Janssen et al., 2012; Peled, 2011; Zuiderwijk, Janssen, Choenni, et al., 2012）。此外，政府機關應該與民間公眾建立合作管道，透過開放資料的應用以結合私部門和公眾的力量，協助政府機關解決業務上的難題與挑戰等，進一步達到公私協力的目標（黃心怡等，2016；Zuiderwijk et al., 2016）。

㈣ 開放資料的評估相關研究

在開放資料的持續發展之下，許多研究者亦於近年來提出多種開放資料的評估模式與架構，以探討政府機關於開放資料的投入情形（Sandoval-Almazan & Gil-Garcia, 2016; Veljković, Bogdanović-Dinić, & Stoimenov, 2014）。其中Kalampokis、Tambouris與Tarabanis（2011）提出開放資料的發展階段預測，指出開放資料的四個可能發展階段。第一階段是指個別政府機關的資料開放，第二階段是指跨機關部門與公共組織的資料整合開放，第三階段是指政府機關與非公部門組織的資料彙整開放，而第四階段為政府機關、非公部門組織與民間公眾資料（如社群資料等）之納入整合開放。在此過程中，開放資料的範疇逐漸擴展，從相對較狹隘的政府機關資料擴大至納入公共組織、非公部門單位如民間企業組織，和公眾社群等之資料。

Lourenço（2015）則是針對開放資料平台進行評估，提出七個資料集衡量構面，分別為品質（quality）、完整性（completeness）、近用性（accessibility）、易用性（usability）、時效性（timeliness）、價值（value and usefulness），與粒度（granularity）。Thorsby、Stowers、Wolslegel與Tumbuan（2017）亦針對美國data.gov網站所呈列城市的開放資料網站進行分析評比，主要著重於兩大面向的衡量，分別為網站功能與資料集。網站功能面向的評估指標為好用性、視覺呈現、互動性、教學功能、應用程式介面與網站使用政策之是否提供等，資料集面向乃涵蓋資料集數量與種類等指標。此外，朱斌妤與曾憲立（2016）綜整相關開放資料平台的評估研究，指出常見評估構面主要分為四個類型，分別為平台一般特徵、資料集特性、資料集操作性，和互動功能如線上討論機制。此兩位學者亦進一步從資料治理角度來進行開放資料平台的內容評估，所採納之構面共有四個，分別為安全性、可近性、資料品質與其它功能，並在此四個構面之下再分別設立對應的衡量指標。

在國家層級的開放資料發展方面，相關國際組織也提出評估架構，用以進行以國家為單位的跨國比較衡量，例如開放知識基金會（Open Knowledge International）發展的Global Open Data Index（https://index.okfn.org），著重於資料集數量、資料集免費取得與否、資料集檔案格式、授權資訊，和詮釋資料等指標的衡量。另外，Tim Berners-Lee所創辦的網際網路基金會（World Wide Web Foundation）提出Open Data Barometer（https://opendatabarometer.org）來衡量各國開放資料的發展，亦是從整體國家層面探討，衡量構面的範圍涵蓋相關利害關係人，諸如政府機關、公民團體與私部門企業組織等的參與程度，並衡量開放資料集的相關構面，如資料集數量、資料集近用性與資料集創新應用等開放進度，並嘗試探討開放資料對於整體政治、經濟與社會所帶來的衝擊影響。

在個別政府機關的開放資料推行評估方面，Solar、Concha與Meijueiro（2012）則提出開放資料成熟度評估模式（Open Data Maturity Model），主要從三個面向進行評估，分別為制度與法令面向、技術與資料面向、公眾互動與合作面向。制度與法令面向是評估政府機關對於開放資料的實行是否有明確的目標、機關的策略與業務是否能與開放資料的政策目標結合、機關開放資料的實行是否受到既有內部與外部法規的影響，和機關本身於開放資料的管理、推行，和訓練等能力。其下可再分三個子面向，分別為策略、領導與準備度、法令規範，和管理運作。技術與資料面向則是評估政府機關於開放資料的實行上是否具備相關的技術能力與提供符合開放資料原則的資料集。其下可再分三個子面向，分別為資料可得性、資料近用性，和資料內容格式。最後，在公眾互動與合作面向上，著重於評估政府機關於開放資料的實行過程間，是否有推

廣資料使用、是否提供相關協助，和與公眾之間是否有溝通管道等以促進開放資料的使用和發展。其下可再細分為子面向，分別為鼓勵公眾於資料集的使用和鼓勵公眾於開放資料政策的參與合作。此外，英國的開放資料學院也提出公部門組織於開放資料推行的評估模式，其評估面向亦著重機關於開放資料的策略、開放資料的管理運作、開放資料的能力訓練，和與開放資料使用者的互動等（Open Data Institute, 2015）。

㈤小結

我國中央與地方機關已於近年來逐步投入開放資料的推行，個別層級機關於開放資料的實行上也累積了相關實作經驗，然個別機關受到本身組織能力資源、資訊環境，和內外部法令規範等因素影響之下，而使得機關之間的開放資料進程上有差異性存在。此外，如前文所述，大多數開放資料的評估研究乃從外部觀察者角色進行評估，評估對象主要為政府機關的開放資料平台，和平台所開放資料集的種類與資料集的品質等，並常見以整體國家層級為單位進行評估探討。而由個別政府機關本身進行自行評估的研究較為有限，然而機關在開放資料的整體生態體系中乃扮演根本的核心角色，因此亦值得嘗試從機關自身角度進行評估，以期能從另個角度取得適切的實證資料，以分析機關於開放資料實行的近況與實務，而能與前述其它架構的評估研究互補之。

前述Solar等（2012）與英國開放資料學院（Open Data Institute, 2015）所提出的架構皆著重於個別政府機關的開放資料推行現況評估。此兩架構的評估面向相近，皆包含了機關於開放資料推行的策略、管理運作、技能訓練，和與公眾互動等，然Solar等人架構的評估面向較廣，亦有進一步細分子面向部分，且涵蓋到機關領導、法令規範、政策制定、資料內容格式等，亦即對於評量面向之區分較為細緻。且此架構所衡量的面向亦呼應前述文獻探討所指的開放資料影響因素，諸如相關政策、法令規範、機關領導、資料開放流程與整合、相關技能訓練、資料可得性與近用性、資料使用回饋，和與資料使用人之間互動等。如Solar等的架構分為三大面向，分別為「制度與法令」、「技術與資料」、「公眾互動與合作」，其下再細分為八個子面向，分別為「策略、領導與準備度」、「法令規範」、「管理運作」、「資料可得性」、「資料近用性」、「資料內容格式」、「鼓勵公眾於資料集的使用」、「鼓勵公眾於開放資料政策的參與合作」，此八個子面向即呼應前述文獻探討所指的影響因素，亦是能適當評估政府機關於開放資料生態體系內所扮演角色，亦即機關於開放資料實行的成熟度情況。

因此，本研究引用Solar等（2012）所提出開放資料成熟度架構，以我國中央與地方政府機關作為研究場域，嘗試了解我國政府機關的開放資料推行現況，以探討以下研究問題：1. 我國政府機關於開放資料的投入與準備程度之情況為何？ 2. 我國不同層級的政府機關（中央機關、六都機關與非六都地方機

關）於開放資料的投入與準備程度上是否有差異存在？以期了解政府機關在開放資料實行上，有那些相關面向較為不足，而需要在治理方式上作調整與改變，以加強現有開放資料的政策擬定與推行方式，和調配相關資源以協助機關的參與和推行。

三、研究設計與實施

本研究透過問卷調查方式以蒐集實證資料進行分析。研究調查問卷的建構主要分成兩部分，第一部分為調查受訪機關的基本資料，用以區別中央機關、六都機關與非六都地方機關，與了解受訪機關參與於開放資料推行的歷程時間。第二部分乃參考Solar等（2012）所提出的開放資料成熟度架構與其量表題目，據以發展問卷題項，是以從前述三個面向下八個子面向來進行調查，分別為制度與法令面向下之「策略、領導與準備度」、「法令規範」、「管理運作」，技術與資料面向下之「資料可得性」、「資料近用性」、「資料內容格式」，和公眾互動與合作面向下之「鼓勵公眾於資料集的使用」、「鼓勵公眾於開放資料政策的參與合作」。此八個子面向亦呼應前述文獻探討所指出的開放資料影響因素。

研究調查問卷的題項是以李克式量表之五點尺度設計之，分別為非常不符合(1)、不符合(2)、普通(3)、符合(4)，與非常符合(5)，以衡量中央及地方機關在開放資料的推展近況。每題題項亦設有「無法確定」之選項，以避免受訪單位人員對於不了解的題目提供錯誤資訊。研究者亦與開放資料領域的其他學者進行討論，針對問卷題目內容之合宜性以及文句流暢性進行調整，用以建立專家內容效度，以完成正式研究調查問卷。

而研究調查問卷的發送對象分別為中央部會機關、六都機關，和非六都地方機關。中央機關主要以行政院部會為主的一級至三級行政機關。六都機關為台北市、新北市、桃園市、台中市、台南市與高雄市所屬的一級行政機關。非六都地方機關為其它地方縣市政府的府內單位與一級行政機關。本研究總共向666個政府機關發放研究調查問卷，其中包含145個中央機關、172個六都機關、349個非六都地方機關。問卷的發放方式是透過公部門之電子公文系統以寄送相關說明，由機關熟悉或負責開放資料業務之人員透過網路填寫線上問卷。施測時間為2017年5月至6月，約略一個月時間。在扣除填答缺漏問卷後，收回有效問卷為507份，約為總共發放問卷76.12%。其中，中央機關共收回132份，六都機關共收回172份，非六都地方機關共收回203份。然回收507份有效問卷中有41份問卷回應為尚未執行開放資料，其中，中央機關0份、六都機關5份、非六都地方機關36份。在扣除此41份問卷後，總共剩下466份有效問卷，為總發放問卷之69.97%，中央機關為132份、六都機關為167份、非六都地方機關共167份。此外，由於研究問卷各題項皆有「無法確定」之選項。因

此，在資料分析中，題項之回應數量*N*會是小於或等於466之情況。

本研究是使用套裝軟體SPSS進行資料處理，針對問卷各題項進行描述性統計分析，並將各題項之實證資料分群為中央機關、六都機關，和非六都地方機關以進行推論性統計分析，先進行變異數同質性假設檢定（Levene），接續採用單因子變異數分析（ANOVA）或Welch檢定，並視結果再採用Scheffé或Games-Howell事後多重比較檢定。

四、分析與發現

於中央機關方面，問卷發送至145個機關，總共回收132份有效問卷，回收率為91.03%。其中無機關尚未執行開放資料，執行未滿一年的機關僅為10%、執行一至二年的機關為11%、執行二至三年的機關為28%、執行三年以上的機關則超過半數，為51%，可知多數中央機關已經參與開放資料的執行，並已累積較多年的執行經驗。於六都機關方面，問卷發送至172個機關，總共回收172份有效問卷，回收率為100%。其中尚未執行開放資料之機關亦僅為3%，執行未滿一年的機關為5%、執行一至二年的機關為24%、執行二至三年的機關為27%、執行三年以上的機關則為41%。可知多數的六都機關也已經參與開放資料的執行，並也已累積較多年的執行經驗。而於非六都地方機關方面，問卷發送至349個機關，總共回收203份有效問卷，回收率為58.17%。其中尚未執行開放資料之機關為18%，執行未滿一年的機關為18%、執行一至二年的機關為24%、執行二至三年的機關為19%、執行三年以上的機關為21%。初步顯示尚有許多非六都地方機關並未參與開放資料的實行，且非六都地方機關推行開放資料的歷程時間較短，需要鼓勵其於開放資料實行的參與與持續投入。後續小節乃採用上述Solar等（2012）之開放資料成熟度架構的面向與子面向來呈現研究發現。

㈠制度與法令面向

1. 策略、領導與準備度

在此子面向下，如表1所示，共有三個題項，以Q1「機關開放資料策略與中央政府的政策一致」的程度最高（平均數$M = 4.151$），其中85.4%為符合以上、12.6%為普通、2%為不符合以下。其次為Q2「機關高層對於開放資料有足夠的了解，以利推動相關政策的執行」（$M = 3.941$），其中74.7%為符合以上、19.2%為普通、6.1%為不符合以下。最後則為Q3「機關能與其它機關溝通協調以推動開放資料」（$M = 3.871$），其中73%為符合以上、21.4%為普通、5.6%為不符合以下。顯示多數機關認同其開放資料策略是與中央政府一致；而在機關高層於開放資料的認知了解和與其它機關的溝通協調部分，皆約略有25%表示為普通與不符合，顯示有可再加強的空間。

表1　機關執行開放資料之策略、領導與準備度

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q1：貴機關的開放資料策略與中央政府政策是一致的（$N = 451$）	4（0.9%）	5（1.1%）	57（12.6%）	238（52.8%）	147（32.6%）	4.151	0.7450
Q2：貴機關高層對於開放資料有足夠了解，以利推動相關政策的執行（$N = 454$）	7（1.5%）	21（4.6%）	87（19.2%）	216（47.6%）	123（27.1%）	3.941	0.8857
Q3：貴機關能夠與其它機關作好必要溝通協調，以推動開放資料（$N = 449$）	4（0.9%）	21（4.7%）	96（21.4%）	236（52.5%）	92（20.5%）	3.871	0.8190

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene 變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央 vs. 六都	中央 vs. 非六都地方	六都 vs. 非六都地方
Q1	$N = 130$ $M = 4.385$ $SD = 0.698$	$N = 162$ $M = 4.210$ $SD = 0.663$	$N = 159$ $M = 3.899$ $SD = 0.789$	$p = .308$	ANOVA $F = 17.111$ $p = .000$	Scheffé	$p = .121$	$p = .000$	$p = .001$
Q2	$N = 131$ $M = 4.229$ $SD = 0.855$	$N = 164$ $M = 3.927$ $SD = 0.848$	$N = 159$ $M = 3.717$ $SD = 0.887$	$p = .384$	ANOVA $F = 12.650$ $p = .000$	Scheffé	$p = .012$	$p = .000$	$p = .094$
Q3	$N = 127$ $M = 4.102$ $SD = 0.754$	$N = 166$ $M = 3.831$ $SD = 0.784$	$N = 156$ $M = 3.724$ $SD = 0.869$	$p = .201$	ANOVA $F = 8.005$ $p = .000$	Scheffé	$p = .018$	$p = .001$	$p = .493$

而根據表1的分組比較分析所示，於Q1題項，中央機關（$M = 4.385$）與六都機關（$M = 4.210$）認同其開放資料策略是與中央政府政策一致之程度較高，且兩者認同無顯著差異，皆顯著高於非六都地方機關（$M = 3.899$）的認同。而在Q2題項，中央機關（$M = 4.229$）之機關高層在開放資料的了解程度上較高，且顯著高於六都（$M = 3.927$）與非六都地方（$M = 3.717$）機關之機關高層，較有利於相關政策的推動與執行，而六都與非六都地方機關之機關高層在開放資料的了解程度上相近，並無顯著差異存在。於Q3題項，得知中央機關（$M = 4.102$）亦較能做好與其它機關之間的溝通協調，以促進開放資料的實行，而六都（$M = 3.831$）與非六都地方（$M = 3.724$）機關在與其他機關溝通協調的能力相近，並沒有顯著差異存在。

2. 法令規範

在法令規範子面向，如表2所示，共有三個題項，以Q5「開放資料執行可以符合機關內部既有的法令規範」的程度最高（$M = 4.234$），其中91.3%為符合以上、7.8%為普通、不到1%為不符合以下。其次為Q4「機關的開放資料執行可以符合機關外部既有的法令規範」（$M = 4.162$），其中88.2%為符合以上、10.9%為普通、不到1%為不符合以下。最後為Q6「機關的開放資料有提供明確的資料使用授權條款」（$M = 3.949$），然其亦達到相當於符合的程度。其中

78.3%為符合以上、18.1%為普通、3.7%為不符合以下。可知大多數機關的開放資料執行能夠符合機關內外部的既有法令規範，並多數備有明確的開放資料授權條款。

表2 機關執行開放資料之法令規範

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q4：貴機關的開放資料執行可符合機關外部既有法令規範（$N = 450$）	1（0.2%）	3（0.7%）	49（10.9%）	266（59.1%）	131（29.1%）	4.162	0.6491
Q5：貴機關的開放資料執行可符合機關內部既有法令規範（$N = 449$）	1（0.2%）	3（0.7%）	35（7.8%）	261（58.1%）	149（33.2%）	4.234	0.6346
Q6：貴機關的開放資料有提供明確的資料使用授權條款（$N = 437$）	2（0.5%）	14（3.2%）	79（18.1%）	200（45.8%）	142（32.5%）	3.949	1.0572

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央vs.六都	中央vs.非六都地方	六都vs.非六都地方
Q4	$N = 128$ $M = 4.313$ $SD = 0.585$	$N = 164$ $M = 4.213$ $SD = 0.584$	$N = 158$ $M = 3.987$ $SD = 0.723$	$p = .418$	ANOVA $F = 10.067$ $p = .000$	Scheffé	$p = .419$	$p = .000$	$p = .007$
Q5	$N = 128$ $M = 4.406$ $SD = 0.594$	$N = 163$ $M = 4.276$ $SD = 0.548$	$N = 158$ $M = 4.051$ $SD = 0.703$	$p = .069$	ANOVA $F = 12.254$ $p = .000$	Scheffé	$p = .206$	$p = .000$	$p = .005$
Q6	$N = 128$ $M = 4.289$ $SD = 0.834$	$N = 164$ $M = 4.049$ $SD = 1.038$	$N = 158$ $M = 3.570$ $SD = 1.125$	$p = .007$	Welch $p = .000$	Games-Howell	$p = .074$	$p = .000$	$p = .000$

再根據表2的分組比較所示，於Q4、Q5、Q6三題項，中央機關（$M = 4.313$, $M = 4.406$, $M = 4.289$）與六都機關（$M = 4.213$, $M = 4.276$, $M = 4.409$）的開放資料執行較能符合外部與內部既有的法令規範、亦較有提供明確的資料使用授權條款，兩者於此三題項的符合程度相近，並無顯著差異存在，然皆顯著高於非六都地方機關（$M = 3.987$, $M = 4.051$, $M = 3.570$）。

3. 管理運作

在管理運作子面向，如表3所示，共有三個題項，以Q9「機關已逐漸整合開放資料原則到既有業務的執行」（$M = 3.706$）的程度較高，其中63.8%為符合以上、27.9%為普通、8.3%為不符合以下。其次為Q8「機關建有標準程序以推動開放資料」（$M = 3.664$），其中62.6%為符合以上、26.9%為普通、10.4%為不符合以下。最後為Q7「機關能提供同仁訓練以協助其掌握開放資料執行所需的技能與知識」（$M = 3.624$），其中60.9%為符合以上、28.4%為普通、10.7%為不符合以下。此三題項之平均值皆介於普通和符合之間，皆約略有35%至40%為普通與不符合，顯示許多機關尚未完整建立開放資料流程以結合其既有業務，而對於相關業務承辦人員所需掌握的能力培訓，諸如資料集彙整、去識別化處理等，亦有可加強的空間。

表3　機關執行開放資料之管理運作

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q7：貴機關能提供同仁訓練以協助其掌握開放資料執行所需的技能與知識（$N = 458$）	10（2.2%）	39（8.5%）	130（28.4%）	213（46.5%）	66（14.4%）	3.624	0.9088
Q8：貴機關建有標準程序以推動開放資料（$N = 449$）	10（2.2%）	37（8.2%）	121（26.9%）	207（46.1%）	74（16.5%）	3.664	0.9237
Q9：貴機關已逐漸整合開放資料原則到既有業務的執行（$N = 445$）	7（1.6%）	30（6.7%）	124（27.9%）	210（47.2%）	74（16.6%）	3.706	0.8782

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央vs.六都	中央vs.非六都地方	六都vs.非六都地方
Q7	$N = 131$ $M = 3.763$ $SD = 0.858$	$N = 166$ $M = 3.651$ $SD = 0.907$	$N = 161$ $M = 3.484$ $SD = 0.936$	$p = .224$	ANOVA $F = 3.548$ $p = .030$	Scheffé	$p = .566$	$p = .033$	$p = .252$
Q8	$N = 129$ $M = 4.008$ $SD = 0.805$	$N = 166$ $M = 3.614$ $SD = 0.899$	$N = 154$ $M = 3.429$ $SD = 0.962$	$p = .001$	Welch $p = .000$	Games-Howell	$p = .000$	$p = .000$	$p = .177$
Q9	$N = 129$ $M = 3.891$ $SD = 0.841$	$N = 164$ $M = 3.646$ $SD = 0.863$	$N = 152$ $M = 3.612$ $SD = 0.907$	$p = .186$	ANOVA $F = 4.188$ $p = .016$	Scheffé	$p = .059$	$p = .028$	$p = .940$

接續，根據表3的分組比較分析，在Q7題項，由於中央機關（$M = 3.763$）與非六都地方機關（$M = 3.484$）之差異達到顯著程度，顯示相較於非六都地方機關，中央機關較能提供同仁適當訓練，以協助其掌握執行開放資料所需的能力與知識。然中央機關與六都機關（$M = 3.651$）、六都與非六都地方機關在此題項之差異皆未達到顯著。於Q8題項，得知中央機關（$M = 4.008$）建有標準程序以推動開放資料的程度較高，皆顯著高於六都機關（$M = 3.614$）與非六都地方機關（$M = 3.429$），而六都機關與非六都地方機關之差異並未達到顯著。而於Q9題項，可知中央機關（$M = 3.891$）與六都機關（$M = 3.646$）之差異、六都與非六都地方機關（$M = 3.612$）之差異皆未達到顯著，然中央機關與非六都地方機關之差異是為顯著，顯示中央機關較能整合開放資料實行到既有業務上，且顯著高於非六都地方機關。

㈡技術與資料面向

1. 資料可得性

在資料可得性下，如表4所示，共有兩個題項，其中以Q11「機關對於開放資料的持續更新，有相關人工或自動流程處理」的程度較高（$M = 4.055$），其中80%為符合以上、15.8%為普通、4.1%為不符合以下。而Q10「機關有完整開放業務過程中所蒐集與產製的資料」的程度較低（$M = 3.606$），其中58%為符

合以上、32.8%為普通、9.3%為不符合以下，顯示多數機關對於其所開放的資料集會進行持續維護與更新。此外，雖然完全開放為政府開放資料的原則之一，然僅有近六成的機關同意其會完整開放業務上所產製蒐集的資料集，此可能肇因於資料集屬性、隱私安全與是否收費等顧慮。

表4　機關執行開放資料之可得性

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q10：貴機關有完整開放業務過程所蒐集與產製的資料（$N = 442$）	10 （2.3%）	31 （7.0%）	145 （32.8%）	193 （43.7%）	63 （14.3%）	3.606	0.8953
Q11：貴機關對於開放資料的持續更新，有相關人工或自動流程處理（$N = 436$）	1 （0.2%）	17 （3.9%）	69 （15.8%）	219 （50.2%）	130 （29.8%）	4.055	0.7946

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央 vs. 六都	中央 vs. 非六都地方	六都 vs. 非六都地方
Q10	$N = 127$ $M = 3.772$ $SD = 0.875$	$N = 163$ $M = 3.546$ $SD = 0.876$	$N = 152$ $M = 3.533$ $SD = 0.920$	$p = .494$	ANOVA $F = 3.075$ $p = .047$	Scheffé	$p = .103$	$p = .085$	$p = .992$
Q11	$N = 127$ $M = 4.268$ $SD = 0.740$	$N = 160$ $M = 4.156$ $SD = 0.669$	$N = 149$ $M = 3.765$ $SD = 0.881$	$p = .002$	Welch $p = .000$	Games-Howell	$p = .384$	$p = .000$	$p = .000$

進一步依據表4的分組比較分析，於Q10題項，發現中央機關（$M = 3.772$）、六都機關（$M = 3.546$）與非六都地方機關（$M = 3.533$）於此題項之差異皆未達到顯著，顯示三者在是否有完整開放業務過程所蒐集與產製資料的程度上相近，並無顯著不同，皆介於普通與符合之間。而在Q11題項，中央機關（$M = 4.268$）與六都機關（$M = 4.156$）在開放資料持續更新之程度上較高，兩者之間並無顯著差異，然皆顯著高於非六都地方機關（$M = 3.765$）。

2. 資料近用性

在資料近用性下，如表5所示，有三個題項，其中以Q13「機關有提供開放資料的詮釋資料說明」的程度較高（$M = 3.941$），其中74.8%為符合以上、20%為普通、5.3%為不符合以下。其次為Q12「機關透過資料開放平台或應用程式介面（API），以達到便利與自動的開放資料提供」（$M = 3.863$），其中71.2%為符合以上、19.1%為普通、9.7%為不符合以下。最後是Q14「機關能應用鏈結資料（Linked Data）技術，以協助於相關平台上搜尋開放資料」（$M = 3.472$），其中53.2%為符合以上、29%為普通、17.7%為不符合以下。顯示多數機關於開放資料時有提供相關詮釋資料說明，並能運用相關平台或應用程式介面（Application Programming Interface, API）方式提供資料；然尚有25%至28%之機關表示為普通與不符合以下，有可再加強的空間。此外，在機關是否

能運用鏈結資料技術方面，僅約五成表示為符合以上，且此題項之填答數僅為417，亦即許多機關填答者選擇無法確定，顯示許多機關對於鏈結資料的觀念尚較為陌生。

表5　機關執行開放資料之近用性

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q12：貴機關透過資料開放平台或應用程式介面（API），以達到便利與自動的開放資料提供（$N = 451$）	11（2.4%）	33（7.3%）	86（19.1%）	198（43.9%）	123（27.3%）	3.863	0.9792
Q13：貴機關有提供開放資料的詮釋資料說明（$N = 456$）	5（1.1%）	19（4.2%）	91（20.0%）	224（49.1%）	117（25.7%）	3.941	0.8483
Q14：貴機關能應用鏈結資料技術，以協助於相關平台上搜尋開放資料（$N = 417$）	11（2.6%）	63（15.1%）	121（29.0%）	162（38.8%）	60（14.4%）	3.472	0.9990

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央vs.六都	中央vs.非六都地方	六都vs.非六都地方
Q12	$N = 129$ $M = 4.023$ $SD = 0.931$	$N = 167$ $M = 4.006$ $SD = 0.882$	$N = 155$ $M = 3.574$ $SD = 1.057$	$p = .001$	Welch $p = .000$	Games-Howell	$p = .986$	$p = .001$	$p = .000$
Q13	$N = 129$ $M = 4.140$ $SD = 0.855$	$N = 166$ $M = 4.078$ $SD = 0.739$	$N = 161$ $M = 3.640$ $SD = 0.870$	$p = .002$	Welch $p = .000$	Games-Howell	$p = .794$	$p = .000$	$p = .000$
Q14	$N = 118$ $M = 3.556$ $SD = 1.004$	$N = 151$ $M = 3.432$ $SD = 1.066$	$N = 148$ $M = 3.419$ $SD = 0.941$	$p = .101$	ANOVA $F = 0.838$ $p = .433$	Scheffé	$p = .601$	$p = .994$	$p = .495$

接續，如表5的分組比較所示，在Q12題項，可知中央機關（$M = 4.023$）與六都機關（$M = 4.006$）在運用資料開放平台或API以提供開放資料之程度較高，且兩者於此題項之差異並無顯著，然皆顯著高於非六都地方機關（$M = 3.574$）。而在Q13題項，同樣顯示中央機關（$M = 4.140$）與六都機關（$M = 4.078$）較有提供開放資料之詮釋資料說明，兩者於此題項之差異並未達顯著，亦皆顯著高於非六都地方機關（$M = 3.640$）。而於Q14題項，實證資料顯示中央機關（$M = 3.556$）、六都機關（$M = 3.432$）、非六都地方機關（$M = 3.419$）在是否能應用鏈結資料技術的程度上並無顯著差異存在，皆介於普通與符合之間。

3. 資料內容格式

在資料內容格式下，如表6所示，有兩個題項，其中以Q15「機關使用非專屬的資料格式（如CSV, JSON等）提供開放資料」（$M = 4.011$）的程度較高，其中75.2%為符合以上、18.2%為普通、6.7%為不符合以下。顯示多數機關已採用非專屬檔案格式釋出資料，然尚有約25%的機關回應為普通與不符合以

下，尚未完全達到開放資料格式之三星等的建議要求。其次為Q16「開放資料為業務所產製的原始資料，非經再製處理過的資料」（M = 3.726），其中66.8%為符合以上、22.9%為普通、10.3%為不符合以下，亦顯示尚有約33%的機關並非直接開放其業務上所蒐集產製的原始資料，而會經過再製處理後釋出，並未達到開放資料原則之一的資料完整性（primary）要求。

表6　機關執行開放資料之資料內容格式

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q15：貴機關使用非專屬資料格式（如CSV, JSON等）提供開放資料，以促進使用（N = 451）	4（0.9%）	26（5.8%）	82（18.2%）	188（41.7%）	151（33.5%）	4.011	0.9104
Q16：貴機關的開放資料為業務所產製的原始資料，非經再製處理過的資料（N = 446）	8（1.8%）	38（8.5%）	102（22.9%）	218（48.9%）	80（17.9%）	3.726	0.9151

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央vs.六都	中央vs.非六都地方	六都vs.非六都地方
Q15	N = 130 M = 4.177 SD = 0.858	N = 165 M = 4.188 SD = 0.801	N = 156 M = 3.686 SD = 0.976	p = .010	Welch p = .000	Games-Howell	p = .993	p = .000	p = .000
Q16	N = 128 M = 3.789 SD = 0.902	N = 163 M = 3.736 SD = 0.915	N = 155 M = 3.665 SD = 0.928	p = .923	ANOVA F = 0.663 p = .516	Scheffé	p = .887	p = .523	p = .784

後續，再以表6的分組比較進行探討，在Q15題項，可知中央機關（M = 4.177）與六都機關（M = 4.188）使用非專屬開放資料格式的程度較高，而中央機關與六都機關於此題項之差異並無顯著，皆顯著高於非六都的地方機關（M = 3.686）。於Q16題項，根據實證資料所示，中央機關（M = 3.789）、六都機關（M = 3.736）與非六都地方機關（M = 3.665）在是否直接開放業務所蒐集產製之原始資料的程度上並無顯著差異存在。

㈢公眾互動與合作面向

1. 鼓勵公眾於資料集的使用

在鼓勵公眾使用資料集上，如表7所示，共有三個題項，以Q18「機關建有機制以處理公眾於開放資料取得與使用上的疑惑與問題」（M = 3.735）的程度較高，其中63%為符合以上、29.7%為普通、7.2%為不符合以下。其次為Q17「機關有提供說明、宣導或活動等以鼓勵公眾於開放資料的取得與使用」（M = 3.553），54%為符合以上、33.8%為普通、12.3%為不符合以下。而最低的則是Q19「機關有提供經費獎助等以鼓勵公眾於開放資料的取得與使用」（M = 2.512），僅20.4%為符合以上、22.5%為普通、57.2%為不符合以下。顯示機

關在協助解決資料取用問題與鼓勵資料使用上的投入程度較為有限，此兩題項之回應各約有三成五與四成五，為普通與不符合以下；且當前機關較少採用經費獎勵的方式以鼓勵公眾使用開放資料，不符合以下的比例即將近六成，僅約二成為符合以上。

表7　機關鼓勵公眾於資料集之使用

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q17：貴機關有提供說明、宣導或活動等以鼓勵公眾於開放資料的取得與使用（$N = 447$）	13 （2.9%）	42 （9.4%）	151 （33.8%）	167 （37.4%）	74 （16.6%）	3.553	0.9710
Q18：貴機關建有機制以處理公眾於開放資料取得與使用上的疑惑與問題（$N = 441$）	8 （1.8%）	24 （5.4%）	131 （29.7%）	192 （43.5%）	86 （19.5%）	3.735	0.8969
Q19：貴機關有提供經費獎助等以鼓勵公眾於開放資料的取得與使用（$N = 432$）	73 （16.9%）	174 （40.3%）	97 （22.5%）	67 （15.5%）	21 （4.9%）	2.512	1.0920

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央vs.六都	中央vs.非六都地方	六都vs.非六都地方
Q17	$N = 127$ $M = 3.724$ $SD = 0.923$	$N = 163$ $M = 3.515$ $SD = 0.952$	$N = 157$ $M = 3.452$ $SD = 1.016$	$p = .376$	ANOVA $F = 2.973$ $p = .052$	Scheffé	$p = .190$	$p = .063$	$p = .843$
Q18	$N = 128$ $M = 4.070$ $SD = 0.786$	$N = 163$ $M = 3.681$ $SD = 0.908$	$N = 150$ $M = 3.507$ $SD = 0.896$	$p = .006$	Welch $p = .000$	Games-Howell	$p = .000$	$p = .000$	$p = .203$
Q19	$N = 156$ $M = 2.429$ $SD = 1.148$	$N = 126$ $M = 2.462$ $SD = 1.044$	$N = 150$ $M = 2.633$ $SD = 1.089$	$p = .656$	ANOVA $F = 1.463$ $p = .233$	Scheffé	$p = .969$	$p = .300$	$p = .388$

再根據表7的分組比較分析，於Q17題項，實證資料顯示中央機關（$M = 3.724$）、六都機關（$M = 3.515$）、非六都地方機關（$M = 3.452$）對於是否提供說明宣導等活動以鼓勵公眾使用開放資料的程度上，並未達有顯著差異的存在。在Q18題項，得知中央機關（$M = 4.070$）較有建立機制以處理公眾的開放資料取用問題，且顯著高於六都機關（$M = 3.681$）與非六都地方機關（$M = 3.507$），而六都機關與非六都地方機關於此題項之差異則未達到顯著。而在Q19題項，實證資料指出中央機關（$M = 2.429$）、六都機關（$M = 2.462$）與非六都地方機關（$M = 2.633$）於此題項之回應並無顯著差異，三者之個別平均值皆介於不符合與普通之間，明顯顯示當前機關較少提供經費獎助以鼓勵公眾取用開放資料。

2. 鼓勵公眾於開放資料政策的參與合作

在鼓勵公眾於開放資料政策的參與上，如表8所示，共有兩個題項，以Q21「機關積極地回應公眾對於開放資料推行的討論與建議」的程度較高（$M = 3.762$），其中63.6%為符合以上、29.9%為普通、6.5%為不符合以下。其次為

Q20「機關與公眾之間具有溝通管道以處理公眾對於開放資料推行的討論與建議」（M = 3.608），其中57.2%為符合以上、31.4%為普通、11.5%為不符合以下。然此兩題項之回應約有四成為普通與不符合以下，顯示機關在與公眾之間的開放資料政策溝通管道建立與是否積極回應的程度上，尚有可加強的空間。

表8　機關鼓勵公眾於開放資料政策之參與合作

	非常不符合	不符合	普通	符合	非常符合	平均數	標準差
Q20：貴機關與公眾之間具有溝通管道以處理公眾對於開放資料推行的討論與建議（N = 446）	7（1.6%）	44（9.9%）	140（31.4%）	181（40.6%）	74（16.6%）	3.608	0.9293
Q21：貴機關積極地回應公眾對於開放資料推行的討論與建議（N = 445）	5（1.1%）	24（5.4%）	133（29.9%）	193（43.4%）	90（20.2%）	3.762	0.8735

中央、六都與非六都之分組比較

	中央機關	六都機關	非六都地方機關	Levene變異數同質性檢定	ANOVA/Welch	Scheffé/Games-Howell	中央 vs. 六都	中央 vs. 非六都地方	六都 vs. 非六都地方
Q20	N = 127 M = 3.969 SD = 0.881	N = 163 M = 3.485 SD = 0.952	N = 156 M = 3.442 SD = 0.867	p = .039	Welch	Games-Howell	p = .000	p = .000	p = .909
Q21	N = 128 M = 4.086 SD = 0.823	N = 161 M = 3.708 SD = 0.871	N = 156 M = 3.551 SD = 0.845	p = .151	ANOVA F = 14.477 p = .000	Scheffé	p = .001	p = .000	p = .259

依表8所呈現，於Q20題項，可知中央機關（M = 3.969）較有建立溝通管道以處理公眾對於開放資料政策的建議與想法，且顯著高於六都機關（M = 3.485）與非六都地方機關（M = 3.442），然六都機關與非六都地方機關於此題項之差異並未達到顯著。最後，於Q21題項，實證資料亦顯示中央機關（M = 4.086）較能積極回應公眾於開放資料政策的意見，且顯著高於六都（M = 3.708）與非六都（M = 3.551）之地方機關，而六都機關與非六都地方機關於此題項之回覆亦同樣無顯著差異。

五、討　論

㈠整體政府機關之探討

在制度與法令面向下，共有「策略、領導與準備度」、「法令規範」、「管理運作」三個子面向，根據問卷之資料分析顯示（如圖1），是以「法令規範」題項之符合程度較高。文獻指出機關於執行開放資料時，首要釐清資料集的釋出是否會與現行法規牴觸，諸如資訊公開法、個人資料保護法、著作權法與機關本身所特有的法令條款等（陳曉慧、涂家瑋，2013；戴豪君、顧振豪，2015；

Zuiderwijk, Janssen, Choenni, et al., 2012）。而根據研究之實證資料顯示，大多數機關於開放資料實行時能符合其內部與外部的既有法令規範，且多數機關已備有明確的開放資料授權條款。此外，行政院國家發展委員會已經制定相對詳盡之「政府資料開放授權條款」，發布於我國中央機關的政府資料開放平台，此版本相容於「創用CC授權姓名標示4.0國際版本」（國家發展委員會，2015）。此授權條款亦可作為六都與其它地方政府機關之參考，可直接採用或協助制定與國際接軌的開放資料授權條款。

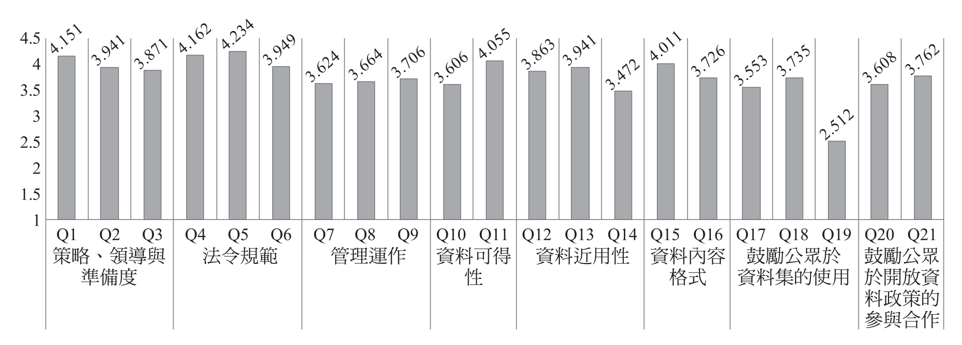


圖1　整體政府機關各題項平均值之長條圖

其次為「策略、領導與準備度」之題項，其中大多數機關同意其開放資料的推展策略乃與中央政府的開放資料政策一致，顯示我國開放資料的推行已逐步從中央與六都往地方政府擴展，且推行策略與政策的彼此一致性可以避免機關之間開放資料實行的多頭馬車問題，有利中央政府於後續我國整體開放資料政策的研擬與階段規劃。然而在機關高層於開放資料的認知、機關與其他機關的溝通協調部分則仍有可再加強的空間。由於開放資料並非傳統的機關既有業務，相關業務承辦人員通常為資訊單位人員，但機關的資料往往存放在業務單位，開放資料的實行亦需業務單位人員的投入參與，而機關領導階層對於開放資料的認知程度將影響其對於相關政策的支持與否，此會影響到機關業務單位人員對於開放資料業務的投入程度與相關資源人力的挹注。此外，跨機關的合作協調亦會在開放資料的準備過程中帶來影響，例如有些機關於資料集的蒐集產製上需仰賴其它機關的協助或上游原始資料的提供，或同性質機關於開放資料時的檔案格式與欄位一致性之協調等。

而「管理運作」題項的符合程度相對較低，可知有許多機關尚未將開放資料的流程建置標準作業程序，亦即機關並未將開放資料業務視為長久性的常態性業務，也連帶影響到機關將開放資料原則融入其既有業務與新創業務的執行，此將會導致後續開放資料實行上時間與人力成本等的增加。此外，尚有許多機關並未提供適當訓練以協助業務承辦人員掌握開放資料所需的技能，然開放資料觀念對於許多業務承辦人員尚屬較為陌生的觀念，且對於開放資料

流程諸如資料集的尋找、彙整、去識別化處理、資料平台使用等，許多業務承辦人員的所知亦較為有限，因而相關權責機關可再加強提供相關說明活動與訓練等。

於技術與資料面向下，列有「資料可得性」、「資料近用性」、「資料內容格式」三個子面向。在「資料可得性」下，實證資料顯示多數機關對於已開放的資料集會進行持續維護，可知公眾將能穩定取得持續更新的資料集，也會提升公眾使用開放資料以進行加值創新的信心與意願。然而實證資料也顯示出僅有近六成的機關會完整開放其業務上所蒐集產製的資料集，此有可能為資料集屬性、個資隱私與收費與否等因素之影響所導致。由於完全開放為開放資料的原則之一，機關可考量參照中央部會設立資料開放諮詢小組的做法，同時納入機關代表與民間代表，以協助機關規劃開放資料的實行，並提供收費與個資疑義等問題之諮詢與協調。

在「資料近用性」下，實證資料顯示多數機關有提供適當的詮釋資料說明，並應用平台或API方式以開放資料，此有助於公眾了解已開放的資料集，並在資料集搜尋上能使用整合式的網站，而在資料集取用上能有API的方式以達到即時取用等。然由於尚有二成半機關的回應程度為普通與不符合以下，表示機關於詮釋資料、開放資料平台與應用程式介面的使用上有仍待加強的空間。而在鏈結資料技術的應用方面，實證資料顯示許多機關對於鏈結資料的觀念相對陌生，雖然鏈結資料應用可使開放資料符合四星與五星標準，但其實作上有一定的技術難度與較高的投入成本，且現階段在實務應用上較為有限，此也反映出國內機關開放資料的實作猶以三星標準為主要目標。

於「資料內容格式」下，實證資料指出多數機關已應用非專屬智財的檔案格式以開放資料，但仍約有兩成的機關回應為普通與不符合以下。此外，問卷資料也顯示尚有一些機關並未直接開放其業務上所蒐集產製的原始資料集，而是開放再製整合處理後的資料集，由於資料集粒度的粗細有可能影響資料集的應用價值，亦即未符合開放資料原則的資料完整性要求。上述兩情況可能肇因於如前述有許多機關並未提供適當教育訓練以培養機關同仁對於開放資料的正確認知，因而導致其資料格式未達到三星標準與未儘量釋出原始資料集。此外，前述建置資料開放諮詢小組的做法，亦有助於協助處理業務承辦人員的疑慮問題。

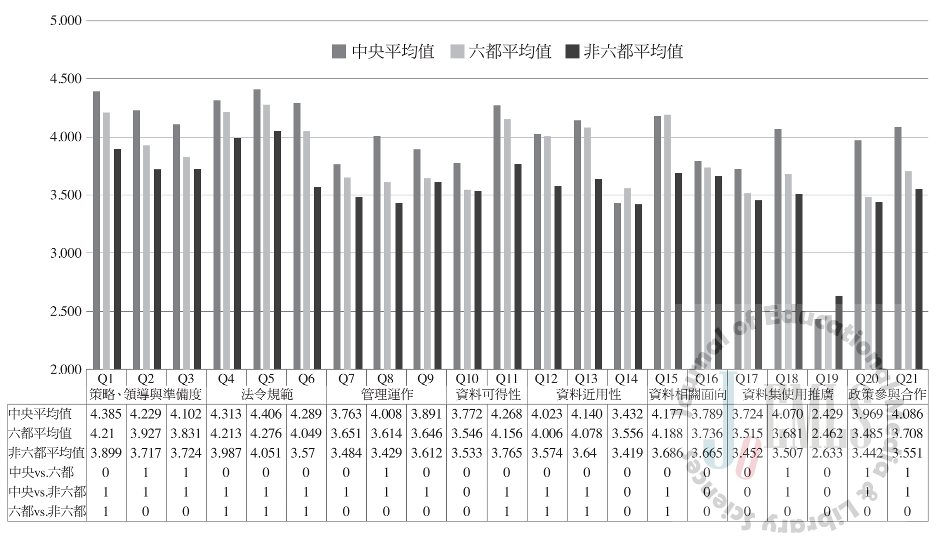
在公眾互動與合作面向下，有「鼓勵公眾於資料集的使用」與「鼓勵公眾於開放資料政策的參與合作」兩個子面向。於「鼓勵公眾於資料集的使用」下，實證資料顯示尚有許多機關並未建立機制以處理公眾於開放資料取用的問題，僅有約六成機關為符合以上，然開放資料的取用不僅單向的接觸，而是雙向的互動，亦即機關應協助處理公眾所提出的資料取用問題，諸如資料欄位短缺、資料說明不清等。文獻亦指出資料使用者的回饋與通報能協助機關校正資料集

的錯誤，以增進機關的資料集品質（Magalhães & Roseira, 2016; Zuiderwijk et al., 2016）。而機關於鼓勵公眾使用開放資料集的投入程度更為有限，僅有五成初為符合以上，且機關更少有採用經費獎助方式以鼓勵開放資料的使用，僅有兩成為符合以上。此亦反映出我國當前開放資料的使用推廣是以相關權責機關為主，例如中央政府是以經濟部工業局，而六都政府是以研考會或資訊局等為單位，常見推廣與獎助方式為開放資料的黑客松活動等。

在「鼓勵公眾於開放資料政策的參與合作」子面向中，實證資料指出，機關在與公眾之間是否備有開放資料政策的溝通管道與是否有積極回應的程度上，尚有可加強的空間，現階段僅有約六成機關為符合以上。機關除開放資料給予公眾之外，可進一步思考如何透過開放資料推行以達到公私協力，亦即公眾參與的開放政府目標，如是否能適當地導入與促進外部思考以融入其開放資料的策略和推行，是否能由政府機關主動拋出議題，透過開放資料的途徑與運用，由民間公眾思考參與，以協助政府機關解決在業務上所面臨的困難與挑戰，或協助政府機關的決策制定與改善既有業務的運作效率等。如前述透過資料開放諮詢小組的做法等，可作為機關與公眾之間的溝通管道，以促進多元領域代表參與機關於開放資料政策的諮詢及協調。

㈡ 中央、六都與非六都地方機關的比較

若以題項折線圖直接視之，中央、六都與非六都地方機關回應之個別趨勢（如圖2）仍是與整體機關回應的趨勢相似（如圖1），主要差異為回應程度上的強弱之別。中央機關在多數題項的回應程度上較高，六都機關次之，而非六都地方機關的回應程度則較低。此亦反映中央機關與六都機關較早投入於開放



	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
	策略、領導與準備度			法令規範			管理運作			資料可得性	
中央平均值	4.385	4.229	4.102	4.313	4.406	4.289	3.763	4.008	3.891	3.772	4.268
六都平均值	4.21	3.927	3.831	4.213	4.276	4.049	3.651	3.614	3.646	3.546	4.156
非六都平均值	3.899	3.717	3.724	3.987	4.051	3.57	3.484	3.429	3.612	3.533	3.765
中央vs.六都	0	1	1	0	0	0	0	1	0	0	0
中央vs.非六都	1	1	1	1	1	1	1	1	1	0	1
六都vs.非六都	1	0	0	1	1	1	0	0	0	0	1

	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
	資料近用性			資料相關面向		資料集使用推廣			政策參與合作	
中央平均值	4.023	4.140	3.432	4.177	3.789	3.724	4.070	2.429	3.969	4.086
六都平均值	4.006	4.078	3.556	4.188	3.736	3.515	3.681	2.462	3.485	3.708
非六都平均值	3.574	3.64	3.419	3.686	3.665	3.452	3.507	2.633	3.442	3.551
中央vs.六都	0	0	0	0	0	0	1	0	1	1
中央vs.非六都	1	1	0	1	0	0	1	0	1	1
六都vs.非六都	1	1	0	1	0	0	0	0	0	0

註：0：平均值無顯著差異，1：平均值有顯著差異

圖2　中央、六都與非六都地方機關各題項平均值之長條圖

資料的執行，因而在整體成熟度上較非六都地方機關為高。由於行政院於2012年中即已要求中央部會機關推行開放資料，因而使多數中央機關較早投入開放資料的執行，累積較多的經驗並持續滾動調整，使其開放資料的策略與中央政府政策趨於一致、機關高層也因此較重視開放資料的推行，並有較多的機會進行跨機關的協調以分享資訊與資料等，也連帶使中央部會機關於技術與資料面向，和公眾互動合作面向上累積較多實務經驗，因而在多數題項回應的程度上較高。另外，在地方自治的制度下，各地方政府對於開放資料的推行有其各自理念與運作模式等，如六都政府投入開放資料推行的時間不一，因而影響其整體成熟度的程度。是以台北市與新北市較早投入，分別於2011年中與2012年底開始實行，之後台中市、台南市、高雄市亦陸續參與，而桃園市政府於2015年底始建立其開放資料平台，相對在相關經驗的累積上會較為有限，因而六都機關在問卷調查的些許回應程度則較中央機關為低。而非六都地方機關於開放資料的實行歷程又更為有限，有些機關仍在觀念建立與初步導入實行的階段，亦有許多機關尚未推行開放資料，是以非六都地方機關於調查題項的回應程度乃較中央機關與六都機關為低。

若進一步以推論性統計進行平均值比較，可發現中央機關與六都機關主要在題項Q2、Q3、Q8、Q18、Q20與Q21的回應程度上有顯著差異存在。相較於六都機關，中央機關高層對於開放資料的了解程度較高，機關亦較能與其它機關做好溝通協調以推行開放資料。中央機關在建有標準作業程序以開放資料的程度亦較六都機關為高，並較多建有相關機制以處理公眾於開放資料取用上的問題。此可能由於如前述行政院的政策要求，使多數中央機關較早重視開放資料業務，因此累積較多實作經驗的緣故。此外，中央機關較多設立有溝通管道以處理公眾於開放資料政策的建議，也比較積極參與回應公眾。此有可能由於行政院在2015年4月即已明令要求中央部會機關設立「政府資料開放諮詢小組」，作為機關與公眾之間的溝通管道，以諮詢及協調開放資料相關政策與事務。且行政院於同年10月起也鼓勵中央部會機關進一步強化與公眾之間的協作機制，以達到公私協力的目標。

而在六都機關與非六都地方機關比較之下，主要在題項Q1、Q4、Q5、Q6、Q11、Q12、Q13與Q15的回應程度上有顯著差異存在。相較於非六都地方機關，多數六都機關較早推行開放資料，在經過滾動修正的經驗累積之下，六都機關的開放資料政策與中央政府政策的一致性較高。在法令規範子面向下，六都機關亦較能符合機關內外部的既有法令規範與提供適當的資料使用授權條款。此外，非六都地方機關參與開放資料的經歷較短，許多機關尚在初步導入階段，因而尚未完全掌握開放資料的觀念與原則，且非六都地方機關的資源較為有限，是以六都機關比較能運用資料開放平台或API技術以便利公眾取用資

料，在資料開放後也較能持續投入以進行後續資料更新。此外，六都機關亦較有提供適當的詮釋資料說明，並比較能應用非專屬資料格式以方便公眾的資料取用。

接續比較中央機關與非六都地方機關的題項平均值，實證資料顯示，大多數題項的回應程度具有顯著差異，皆為中央機關高於非六都地方機關，可知中央機關的整體開放資料成熟度較高。由於非六都地方機關參與開放資料的時間較短，且有許多尚未參與實行，是以應廣泛提供相關教育訓練與推廣說明給予非六都地方機關，以持續倡導開放資料的觀念與實作原則，鼓勵其參與和持續投入。而中央機關之「政府資料開放授權條款」與「資料開放諮詢小組」設立模式亦可提供非六都地方機關，乃至於六都機關做為參考，用以汲取先行機關的經驗等。

此外，值得注意的為中央機關、六都機關，與非六都地方機關於題項Q10、Q14、Q16、Q17與Q19的回應皆無顯著差異。亦即此三類型機關在是否有完整開放所蒐集與產製的資料、是否能應用鏈結資料技術、是否開放原始資料而非再製資料、是否有宣導活動以鼓勵公眾取用資料，與是否有經費獎助資料使用之回應程度上皆無顯著差異。可知並非機關對於開放資料的了解程度較高、推行經驗較久，或持有資源較為豐富，而於這五個題項的回應程度會較高。此可能由於許多機關釋出開放資料時，仍是謹慎考量資料集屬性、個資隱私與安全性等因素，因而選擇性的僅開放部分資料集，並會對原始資料進行再製處理如去識別化與彙整等，而非單純遵守開放資料的完全開放與完整開放之原則。此外，鏈結資料應用的技術門檻與成本較高，需要相當的專業資訊領域知識，對多數機關有一定實行上的難度，是以三類型機關對其掌握度皆明顯較低，且回應程度上並無顯著不同。最後，在機關對於開放資料是否提供宣導活動與經費獎助上，三類型機關之投入程度亦無顯著差異，可能許多機關皆秉持開放資料的公眾推廣等應由相關權責機關主理，因而並非隨機關於開放資料經歷累積之有所不同而看法變動。

六、結　論

過往政府開放資料評估的研究多從外部觀察者的角色進行評估，評估標的主要為開放資料平台、資料集的種類與品質等，並常見以國家層級為單位進行評估探討，而由政府機關本身進行自行評估的研究較為有限。為彌補此研究缺口，本研究採用Solar等（2012）所提出的開放資料成熟度架構，用以呼應文獻探討所指出的開放資料影響因素，透過機關自身角度所提供的實證資料以進行分析，著重於機關的開放資料推行近況評估。本研究亦進一步將實證資料區分為中央機關、六都機關，與非六都地方機關，用以探討不同層級機關於開放資料實行近況上是否有差異性存在。

研究結果顯示多數中央機關與六都機關已經投入開放資料的執行，然而有許多非六都機關尚未參與，且非六都機關實行開放資料的時間歷程較短，需要宣導與鼓勵其於開放資料政策的推行和持續投入。在制度與法令面向部分，多數機關在參與開放資料時能符合其既有的內外部法令規範，並備有明確的使用授權條款。多數機關的開放資料策略亦與中央政府的政策一致，然機關高層對於開放資料的了解和機關之間的相關聯繫協調有可再加強的空間。此外，許多機關尚未將開放資料融入既有業務，且未建立其標準作業程序，而機關對於業務承辦人員所需技能之教育訓練亦有加強的空間。在技術與資料面向下，多數機關已應用平台或API方式以開放資料，並提供適當的詮釋資料說明，和採用非專屬智財的檔案格式，對於已開放的資料集亦會進行後續維護。然許多機關並不會完整開放其所持有的資料集，開放前亦會經過再製整合之處理，而非直接開放其所蒐集產製的原始資料集，且機關對於鏈結資料的應用觀念較為陌生。最後，在公眾互動與合作面向上，許多機關尚未建立機制以回應處理公眾的資料取用問題，對於鼓勵公眾使用資料的投入程度也較為有限，且僅有少數機關有採取經費獎助方式。而機關在開放資料政策之溝通管道的設立與回應的積極程度上皆有可加強的空間存在。

另外，中央機關、六都機關與非六都地方機關的個別回應趨勢相近，主要是回應程度的強弱差別，是以中央機關於整體評估面向的成熟度最高，六都機關次之，非六都地方機關的回應程度較低。本研究亦對於有顯著差異與整體無顯著差異的題項進行討論，並建議中央機關的開放資料經驗，諸如諮詢小組設立、授權條款內容與公私協力概念導入等，皆可作為六都機關與非六都機關的參考。

本研究的調查發現與討論可作為我國政府發展開放資料政策的參考，以了解機關現有治理方式上，開放資料中那些面向較為不足，需作適當調整或改變，以分配有限的資源和加強後續相關政策的擬定與推行方式，從而鼓勵與協助機關於開放資料的參與和持續實行。由於人力與時間之限制，本研究除整體機關探討外，僅先將機關區分成中央、六都與非六都地方進行比較，未來研究可再納入更為細緻化的區分，諸如以機關執行開放資料的時間進行分群討論，或以機關層級和執行時間進行交叉探討，或以單一縣市如台北市、新北市等進行個別比較，相信可從更多不同分析角度取得實證分析結果，作為我國政府持續推動開放資料時之政策研擬參考。

此外，本研究所採用的衡量模型為涵蓋面向較廣的整體性評估，然其對於單一面向的深入了解會較為有限，如有對於個別面向的細部評估等需求，則需要再以質化研究的方式以進行探討。此外，機關於開放資料的推行需要持續地投入人力與軟硬體設施，是以預算和資源的相關評估面向亦可考量加入現有的模型。而現有模型面向下的問卷題項亦可再擴充，以發展更為細緻的評估模

型。最後，本研究所採用的評估模型主要著重於開放資料提供者，亦即為政府機關於開放資料推行現況的評估，然開放資料使用者的參與亦為開放資料生態體系的重要一環，後續相關研究亦可著重於開放資料使用者端的探討，以發展更為整體性的評估研究。

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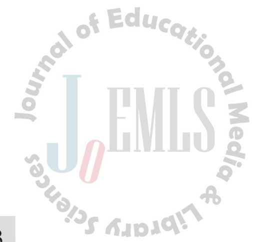
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Research Article

The Maturity Assessment of the Recent Open Data Development in the Context of Taiwan E-Government

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Abstract

Open government data has become an important policy among the government administrations around the world. Similarly, in this global movement, both central and local governments of Taiwan have dedicated efforts and resources to establish open data infrastructure. Nevertheless, because of their respective information environments, agencies possess different capabilities of open data implementations, and different outcomes are achieved. Accordingly, this research adopts and refines an open data maturity model from the literature for the assessment purpose. A quantitative approach by using survey is employed to assess the current development and implementation of open data among Taiwan government agencies. The research also attempts to explore whether central and local government agencies possess similar or different capabilities and commitments in implementing open data. It is expected that the research results can provide insights to practitioners for related policy suggestions and resource allocations. Lastly, this investigation in Taiwan e-Government can also enrich and contribute to the current open data literature from an international perspective.

Keywords: *Open government, Open data, Evaluation, E-government*

SUMMARY

Open Government Data (OGD) has become a concerned issue in recent years, and been regarded as one of important administrative policies of domestic and foreign governments. Making data of public sectors open to the public helps achieve goals of transparency in government and public participation, and encourages innovative application of government data by the public, for promoting economic growth and new industrial development. OGD is expected to lay the foundation of open government by realizing its three pillars, including transparency, participation, and collaboration. However, the progress of open data of different sectors varies. Therefore, the goal of this study is to study the status

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quo of open government data in Taiwan, and to investigate questions addressed below. What are the executive capacities and commitment levels of government sectors in making government data available to all? Is there any difference of executive capacities and commitment levels of different government levels (the Central Government agencies, Six-Municipal Government agencies and local government agencies) in making data open to the public?

In this study, the Open Data Maturity Model proposed by Solar, Concha, and Meijueiro (2012) was adopted for developing survey questions, which were categorized into eight sub-aspects under the three major aspects, including (a) strategy, leadership and establishment, (b) laws and regulations, (c) management in the Establishment and Legal aspect, (d) data availability, (e) data access, (f) data format and content in the Technology and Data aspect, and (g) reuse encouragement, and (h) participation and collaboration in the Data Reuse and Citizen aspect. During the data collection stage, the questionnaires were distributed to 666 government agencies of Taiwan for collecting empirical data. The duration was about one month, and the received valid questionnaires for analysis were 436. Both descriptive and inferential statistics were conducted by using SPSS software.

Results of this study showed that most of the Central and Six-Municipal Government agencies had engaged in making data open to the public, but many local government agencies had not participated yet. Some local government agencies made data open not long ago, and needed help in knowing how to promote open data policies, as well as encouragement for persisting in participation. As to the Law and Regulation aspect, most agencies followed the internal and external laws and regulations, and developed clear use authorization policies. Most agencies' open data strategies were in accordance with policies of the Central Government. However, the higher-level officers of these agencies should enhance their understanding of open data, and the communication and coordination among agencies should be enhanced. In addition, many agencies had not incorporated open data into their existing business, and had not built up a corresponding standard operating procedure yet. The concept of open data is also relatively new for some government officials, and they usually have limited understandings and experiences in searching and aggregating datasets. The process of data de-identification to reduce the concern of privacy impact is also not an easy task. Agencies should help provide and enhance educational training of required skills for relevant personnel in open data implementation.

As to the Technology and Data aspect, most agencies had used open data portal (ODP) or application programming interface (API) for providing open data, provided appropriate descriptions of metadata, adopted a non-proprietary

data format, and kept follow-up maintenance of open datasets. However, many agencies did not open all of the owned datasets, and would re-produce and incorporate the datasets before making them open to the public, that is, they did not open the raw datasets they collected in the first place. Those agencies were also unfamiliar with the application of linked data. This empirical result reflects that the implementation of 4-star and 5-star open data is still difficult for most of the agencies while they possess limited technical capabilities, and the standard of 3-star open data is a more reasonable expectation for most agencies to achieve at this time.

Lastly in the aspect of Participation and Collaboration, many agencies hadn't built up a mechanism for responding to and handling problems regarding data access, and had limited commitment in encouraging the pubic to use data. Only a few agencies adopted approaches of budget rewards. There is still room for enhancing agencies' building up communication channels of open data policies and their activeness in responding to relevant questions. It is expected that feedbacks from open data users can actually help government agencies improve the qualities of their released datasets.

There was a similar trend of individual responses among the Central, Six-Municipal and local government agencies. The major difference lied in the response strength. As to the overall evaluation of response strength, the Central Government agencies had the highest maturity, followed by the Six-Municipal and local government agencies, respectively. In addition, it is worth noting that there were no significant differences among the three types of government agencies in the issues of completely opening collected and produced datasets, applying linked data technology, opening raw/not reproduced datasets, holding activities for encouraging the public to use data, and responding to whether there were budget rewards for data use. It is suggested that the Central Government agencies' experiences of making data open to the public, such as the setting up of OGD Advisory group, contents of use authorization policies (open data license), and introduction of public-private partnership, etc., should be provided for the references of the Six-Municipal and local government agencies.

The results of this study could serve as the reference for government agencies in Taiwan when developing open data policies, to see the insufficient aspects of existing management and implementation of open data. Some corresponding adjustments and changes should be made for enhancing policy making and implementation of open data. It is expected that the limited resources should be appropriately distributed, and government agencies should be encouraged and assisted more in participating and implementing in making data open. The current adopted model of the study uses a broader perspective to assess the maturity of open data implementation among government agencies. However, in terms of the

research results, the further understanding of certain aspects of the agencies could be still limited. It is suggested that qualitative research approach can be employed later to investigate the specific aspects of interests, and the current model can be further extended to include other aspects such as resources and budgets that are also crucial to sustain open data initiatives. The questionnaire items of the current study can also be enhanced for developing a more delicate assessment model. Lastly, while both open data providers and open data users play important roles in an sound open data ecosystem, future research should also focus on the related aspects of open data users for forming a more comprehensive assessment model.

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Does the Learning of Computational Thinking Concepts Interact with the Practice of Digital Curation in Children? A Preliminary Case Study

Chun-Hao Chang

Abstract

Digital storytelling with block-based coding tools for children involved the exercise of both computational thinking (CT) and digital curation (DC). Relevant studies, however, were more concerned with the learning and development of CT concepts rather than the practice of DC. In this regard, the current study aimed to investigate the interrelationship between the learning of CT and DC through digital storytelling, particularly from the standpoint of elementary school children. A total of 35 fifth graders were recruited from a public school in New York City to voluntarily participate in a ten-week digital storytelling workshop where they curated an interactive story within the Scratch environment. Self-made scoring rubrics were implemented to evaluate students' digital storytelling projects from two measures: Computation Measure and Curation Measure. The overall analysis revealed no significant correlations between the two measures. Further investigations, however, on the interrelationship between each of the subcategories of the two measures indicated a number of significant correlations between the learning of CT concepts and the practice of DC. Relevant educational implications were intensively discussed to inform the design of teaching and curriculum.

Keywords: *Computational thinking, Digital curation, Digital storytelling, Scratch, K-12 education*

Introduction

The cultivation of computational thinking (CT) skills at an early age is a topic that has gained universal awareness and acceptance in recent years. In a broad sense, CT skills can be perceived as general information literacy skills that have the potential to benefit young children's cognitive learning and thinking capabilities (Grover & Pea, 2013; Kafai, 2016; Voogt, Fisser, Good, Mishra, & Yadav, 2015). The study of CT produces practical knowledge of how to analyze and solve everyday problems by reflecting on how computer scientists would approach a problem in a systemic fashion. By acquiring this literacy skill, children

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learn not only problem-solving techniques but also fundamental principles of computation. The concepts of CT are abstract in nature, however, and are not easy for children to comprehend. One of the methods commonly adopted to assist children in making sense of abstract CT concepts is interactive, digital storytelling with block-based coding tools (BCTs). A BCT often incorporates a design that encourages children to practice CT concepts within a narrative context, such as an interactive story. A typical BCT, such as Scratch or Blockly, enables children to freely tinker with their ideas by an intuitive drag-and-drop process. In other words, children can delve directly into the learning of rudimentary CT concepts without memorizing complex syntax rules. Children can quickly create functional prototypes of their story ideas by snapping different colors of building blocks together, in a way that is consistent with their Lego building experiences. This process of virtual building block design and construction guides children to discover how each CT concept functions, both individually and together, to support the plot of an interactive story.

Though children were first thought to learn CT concepts by applying computational constructs to the design of digital stories with BCTs, it was later found that they seemed to be immersed in the process of creating story characters, selecting costumes, editing sound clips, or generating animation effects (Adams & Webster, 2012; Kafai, Peppler, & Chapman, 2009). For instance, with Scratch, its abundant multimedia resources, ranging from images, clip art, graphics, and audio clips, encouraged children to constantly use their imaginations to expand the scope of storytelling. Children could use multimedia elements to strengthen the narrative, organization, and interactivity of the story; this was often regarded as a motivating factor rather than a meaningful learning task in a CT classroom. From one standpoint, that of how well children were learning CT skills, this shift of the learning focus from CT concepts to a multimedia presentation could not only distract a student from concentrating on computational constructs but could lead the student to deviate from the original instructional goals. From another standpoint, however, that of library informatics, all of these caveats about learning could be given a new impetus and meaning: They could all be perceived as a form of digital curation (DC) practice, a process that generally involves digital content selection, information filtering, narration structuring, and public sharing (Albion, 2014; Fotopoulou & Couldry, 2015). In fact, when children acted as a multimedia storyteller in a BCT, they did not practice CT skills alone but DC skills as well. They learned how to program their story characters and how to select, filter, and arrange multimedia resources in relation to the plot of a story. Although BCTs were not originally designed for digital curation, they allow children to experience curating a multimedia exhibition of works that address their imaginations.

Following this, the exercise of a child's CT skills and DC skills could be intertwined in digital storytelling activities. This prompts the question of how children would handle these two skills, which are seemingly at variance, at the same time and how digital storytelling with BCTs can propel children to cultivate two sets of skills in one piece of work.

An overview of the literature on the effect of digital storytelling on children's cognitive development has shown that a substantial body of research has focused on the cultivation of CT skills, whereas the development of DC skills is rarely mentioned. Some studies revealed that digital storytelling with a BCT resulted in an effective understanding of abstract CT concepts by elementary school children (Burke & Kafai, 2010; Wilson, Hainey & Connolly, 2013). Others highlighted the effect of digital storytelling on children's critical thinking and creativity (Niemi, Harju, Vivitsou, Viitanen, Multisilta, & Kuokkanen, 2014; Psomos, & Kordaki, 2012) but included little about its effect on their DC skills. Although CT skills and DC skills seemed to vary in nature and scope, they were both essential skill sets for children to attain in order to formulate their mental representations of a problem. They both served as a framework for outlining and guiding a child's cognitive thinking activities. One might ask several questions about the two skill sets, such as what is the relationship between them? Could a student's CT skills become an indicator of his or her DC skills? Could a student's DC skills complement or conflict with his or her CT skills? Are there any possibilities to design and implement an interdisciplinary curriculum to cover both DC and CT skills through one learning task? All these questions await further clarification and elaboration to increase our knowledge about and enhance the discussion of this subject.

Literature Review

Digital Curation and Digital Storytelling

DC is an interdisciplinary concept incorporating aspects of content curation and digital resource presentation used primarily by the scientific and digital library communities respectively (Beagrie, 2006; Molloy, 2014). By definition, DC is basically a process through which a person collects, filters, organizes and presents a particular topic out of a larger collection with digital media, similar to how a museum curator or archaeologist brings together an exhibition from a particular frame of reference (Albion, 2014; Boon, 2011; Dale, 2014; Fotopoulou & Couldry, 2015; O'Neill, 2006). However, the application of DC is not limited to museums or art galleries. In other settings such as libraries, one of a librarian's core duties is to curate reference materials or online resources to support various needs of routine learning and teaching activities. Librarian must

be capable of collecting targeted information effectively through researching, filtering, categorizing and assessing its the relevance to the reader. In this regard, DC can be described one's mental representation of information, through which one imparts his or her own interpretation that is carefully designed and arranged to facilitate learning from the audience's perspective. In other words, DC can be described as a meaningful abstraction of information with aims to present the essence of a selected theme. To further illustrate the process of meaningful information abstraction, Deschaine and Sharma (2015) argued that DC should be implemented as a staged, sequential process that covers activities such as: (a) content collection, (b) content organization, (c) content critique, (d) content conceptualization and (e) content circulation. Though these activities are presented as a list, they do not necessarily occur in linear order, meaning a curator may switch from process to process until the final objectives are achieved. Hence, the curated content is narrative and provides a story as well as reflection of the curator's view of the world. This staged framework not only highlights the core components of DC but also sheds light on the similarity between DC and digital storytelling.

Storytelling is a natural way for human beings to recount experiences and create reasonable order out of experiences (Erickson, 1996; Gottschall, 2013; Moen, 2006). In essence, storytelling is a form of curation. The act of storytelling often begins with selecting a topic, structuring ideas, creating characters and organizing the story's plot, a process that is similar to curate an art exhibition. This procedure helps storytellers externalize their thoughts and imaginations through multimodal representations (Connelly & Clandinin, 1990; Isbell, Sobol, Lindauer, & Lowrance, 2004; Porter, 2004), and henceforth can serve as a pedagogical tool to foster children's thinking and self-reflections (Sadik, 2008). With the advancement of digital technologies, the notion of digital storytelling has emerged to enable new forms of creation. Digital storytelling can be described as ordinary storytelling with the enhancement of digital media or technology tools (Howell & Howell, 2003). Digital stories derive their power by weaving images, music, narrative and voice together, thereby giving deep dimension to characters, situations, experiences, and insights (Rule, 2010). In practice, the process of digital storytelling can be considered as an instance of DC from two standpoints. First, both digital storytelling and DC involve the creation of narratives through active, meaningful selection, organization and filtering of information based on personal perspectives (Mihailidis & Cohen, 2013). For both digital storytelling and DC, the final product is personal and unique, is representative of one's own creativity, and is carried out through a structured thinking framework. The ultimate goal is set to filter out irrelevant information in order to construct a

well-organized, self-contained curation project. Second, both digital storytelling and DC pivot heavily upon one's mental representations of the content to be demonstrated (MacDonald, 1998).

In terms of assessment, three approaches were found in the literature when examining a person's curation skills. Some conducted surveys questions (Creamer, Morales, Crespo, Kafel, & Martin, 2012); some designed self-made scoring rubrics (Cowick, 2018), still others implemented in-depth interviews (Molloy, 2014) to examine differences in students' DC skills. However, since one's curation work tends to be highly context-dependent, it becomes difficult to develop a standardized, unified assessment method that fits all purposes. In this study, we intend to implement scoring rubrics to examine students' in digital storytelling within the Scratch environment. Considering the multimedia features of a Scratch project, we particularly incorporated content interactivity and multimedia design as two new dimensions when assessing students' DC skills. These two dimensions reflect the nature of using digital technologies to curate a story. Therefore, aside from the dimensions of DC summarized in previous literature, following is the framework of DC skills proposed in this study:

- Content selection: the active selection and filtering of the content in order to generate the main theme of the digital story.
- Content organization: the organization and sequencing of the curation content with references to the plot of the digital story.
- Content originality: the originality as well as authenticity demonstrated in the curation content.
- Content interactivity: the level of interactivity and the design of interactive mechanism conveyed through the curation content.
- Multimedia design: the design and integration of various multimedia elements in the curation content.

Computational Thinking and Digital Storytelling

The cultivation of CT skills has listed as one of the core competencies for children to acquire, just like skills in mathematics and sciences. CT refers to a general analytical approach to problem-solving, designing systems and even understanding human behaviors (Barr & Stephenson, 2011, Guzdial, 2008; Wing, 2006; Wing, 2008). It is not a skillset merely for computer scientists to master; instead, it should be treated as a generic literacy skill shared by a wide spectrum of academic disciplines (Wing, 2008; Wolz, Stone, Pearson, Pulimood, & Switzer, 2011). CT related learning activities can be grouped into two categories — comprehension and generation. Comprehension focuses on one's capabilities to outline program structure for testing and tinkering; generation focuses on the ability to implement proper solutions with references to the comprehension

(Robins, Rountree, & Rountree, 2003). It was found a well-trained learner with CT skills should possess two type of knowledge: (a) Knowledge about the computational design plans, which are generic computer program fragments that represent stereotypic action sequences in programming. (b) Knowledge about carrying out the design plan with tools, which capture the conventions in computer programming and guide the composition of the design plans (Soloway, 1984).

Researchers were concerned about whether children could benefit from learning CT knowledge at a broader scope and, in the meantime, cultivate an integrative view on CT concepts (Kurland, Clement, Mawby, & Pea, 1986; Xinogalos, 2012). One of the essential tasks in CT is to generate symbolic abstractions of problems with respect to computational rules to represent a person's mental understanding and thinking. This process involves researching, filtering, categorizing and sense-making, which appears to be similar to the process of telling a story. Thus, engaging children in designing digital stories or animations has become a popular approach to practice basic, abstract CT concepts. In relevant studies, fundamental CT concepts includes the following categories (Brennan & Resnick, 2012):

- Sequence: to design a series of individual steps or sequential instructions for a particular activity.
- Event: to identify the causal relationship among things in a particular activity.
- Conditionals: to make decisions based on certain conditions or assign different outcomes with respect to different conditions
- Loops: to repeat a sequence of instructions until a certain condition is met.
- Variables: to store, retrieve and filter data as a virtual container for a particular activity.

Since the above CT concepts are abstract to children, interactive stories or animations are often used as a vehicle to demonstrate how each CT concept is associated with the plot of a story. For instance, the conditionals concept controls the flow of a digital story. Therefore, digital storytelling can be described as an instance of CT through which a person externalizes his or her understanding of abstract CT concepts. The narrative of a story and interactions among characters can be broke down into single or a combination of CT concepts. Through digital storytelling, students can more effectively recognize how to enhance the interactivity of a story through applying CT concepts. Papert (1980) argued that the development of CT concepts is analogous to building up a microworld to represent a person's conceptual understanding of computational knowledge. In other words, when a storyteller engages in the process of building up a digital

story with a tool such as Scratch, he or she is placed in a self-constructed microworld to testify how CT concepts should be applied to story narratives.

In sum, digital storytelling with BCTs is a learning task that encompasses the exercise of both CT and DC. In other words, when students engage in digital storytelling activities, they seek to achieve the same goals by applying two seemly different abilities at the same time. The learning of DC skills put emphasis on the selection, organization, originality, interactivity and multimedia design of digital content; the learning of CT concepts revolves around the planning, designing and implementation of different computational constructs such as sequence, event, conditionals, loops and variables. In contemplation of the relationship between CT and DC skills, we developed the following three research questions to guide the study.

1. How do students curate a digital story in terms of the five dimensions of DC (i.e., content selection, content organization, content originality, content interactivity and multimedia design)?
2. How do students design a digital story in terms of the five concepts of CT (i.e., event, sequence, conditionals, loops and variables)?
3. In digital storytelling activities, what is the interrelationship between the learning of CT concepts and the practice of DC?

Method

Participants

The study consisted of 35 students (16 males and 19 females) in the fifth grade between the ages of 10 and 11. All students were recruited from a public elementary school in the Washington Heights neighborhood of New York City. Participation in the study was completely voluntary and no incentives were offered for participation. Prior parental consent was obtained along with signed informed consent forms. Each student was asked to attend a 55 minutes storytelling workshop every week for ten consecutive sessions, during which they learned to create an interactive story within the Scratch application. None of the students had any prior computer programming experience or knowledge of the Scratch application.

Research Design and Procedure

The weekly Scratch design sessions were held as a storytelling workshop where students took the role as a storyteller to curate an interactive story based on their preferences. The same instructor was assigned for the workshop with assistances from two on-site teachers throughout the study. Each student was equipped with a labeled personal laptop as the design tool. There was no Internet connection in the classroom, meaning students were only allowed to import multimedia resources from the Scratch application to curate their interactive

stories. The storytelling workshop generally consisted of two parts: the first 30 minutes was reserved for guided instructions, followed by a 25 minutes hands-on Scratch design session. On day one, prior to the beginning of guided instruction, students were taught what constituted a story and what details appealed to the audience through in-class discussions.

The ten-week digital storytelling curriculum consisted of five different types of CT concepts based on Brennan and Resnick's (2012) categorization, including (a) event, (b) sequence, (c) conditionals, (d) variables and (e) loops. These concepts were taught one by one from simple computational construct such as event and sequence to sophisticated computational construct such as conditionals and variables. An overview of the curriculum design framework was illustrated in Figure 1.

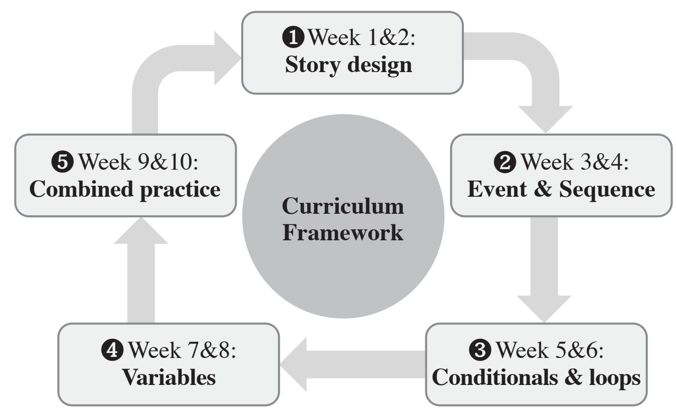


Figure 1 An Overview of the Curriculum Design Framework

Through guided instructions with worked examples, students learned to apply CT concepts one by one to build up their interactive stories through tinkering with Scratch building blocks. Two examples of students' curation project with Scratch were presented in Figure 2.

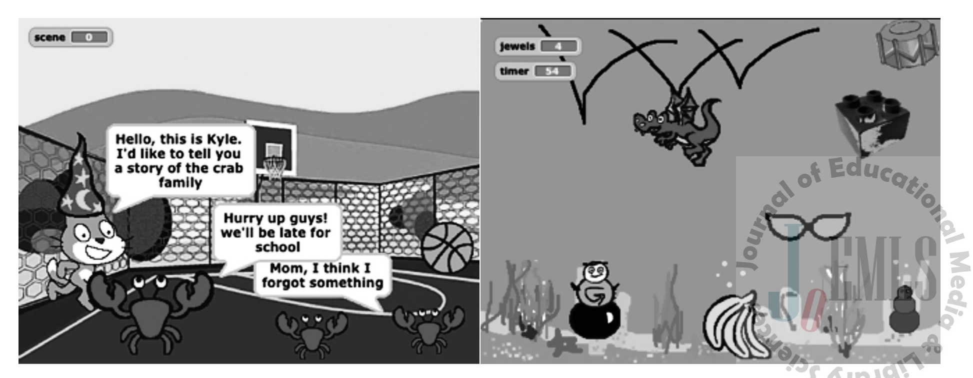


Figure 2 Examples of Student's Digital Curation Project with Scratch

The Scratch application was chosen as the digital storytelling tool for two reasons. From the perspective of CT, Scratch is a block-based, visual programming environment that enables students to quickly grasp CT concepts in an intuitive approach. From the perspective of DC, Scratch offers abundant, ready-made multimedia resources for students to curate a story. These resources include photo images, illustrations, clip art, sound tracks and animation effects. Scratch has been experimented as an effective digital storytelling tool for young children in previous studies (Bratitsis & Ziannas, 2015; Lye & Koh, 2018). Students can easily import these ready-made multimedia elements to their stories. In addition, the share button offered by Scratch allows students to quickly publish their projects with a wider audience in a timely manner. All these functionalities make Scratch an ideal tool for the exercise of both CT and DC skills at the same time.

Measures

There were two measures administered at the end of the workshop to investigate participants' DC and CT skills. The Curation Measure assessed the quality of participants stories from the standpoint of DC while the Computation Measure assessed participants understanding of CT concepts. A customized scoring rubric was created for each of the two measures. For the Curation Measure, the assessment was comprised of five dimensions, including: (a) content selection, (b) content organization, (c) content originality, (d) content interactivity and (e) multimedia design. For the Computation Measure, the assessment was designed in alignment with the curriculum structure, including (a) event, (b) sequence, (c) conditionals, (d) variables and (e) loops. When calculating the scores, three experienced Scratch instructors were invited as raters to assess students' Scratch curation projects. To understand inter rater agreement, the Kendall's W was calculated for the two measures. For the Curation Measure, the Kendall's W is .83; for the CT Measure, the Kendall's W is .94. These values indicated a good inter-rater agreement was achieved for both measures among the three raters.

Results

Analysis of Students' Scratch Curation Projects

Even though all students were instructed to design an interactive story, it was found their final curation projects were quite diversified. To better illustrate the DC project created by students, we attempted to categorize all Scratch curation projects as the following genres: (a) narration (60%), (b) art gallery (18%), video games (7%) and others (15%). In Table 1, we found narration (n = 21) was the most commonly seen genre created by students. Narration was

defined as a story with discernible structural patterns, cause-and-effect sequence of events and development of characters. Aside from narration, 18% of students' Scratch curation project was identified as an art gallery (*n* = 6), meaning they exhibited a collection of artwork based on a specific theme. A video game (*n* = 3) was another genre (7%) in which students designed a simple, interactive video game with predefined game rules to follow. Lastly, there were 15% of students' curation fell into the others (*n* = 5) category as these Scratch projects were simply a display of random pictures that didn't belong to any of the above categories. A breakdown of students' Scratch curation projects was demonstrated in Table 1.

Table 1 An Overview of Students' Scratch Curation Projects

Category	Percentage %	Descriptions
Narrative (*n* = 21)	60	A descriptive story with discernable details.
Art gallery (*n* = 6)	18	A collection of artwork based on a particular theme
Video game (*n* = 3)	7	A video game with predefined game rules to follow
Others (*n* = 5)	15	A visual display of random pictures

Analysis of the Curation Measure

The result of the Curation Measure was presented in Table 2. The mean score of students' overall Scratch curation skill was 2.71 out of 4, which fell between satisfactory and good according to the scoring rubric (see Appendix 1). Students achieved the highest mean score for the content selection dimension (*M* = 3.23, *SD* = 0.69) and the lowest score for the originality (*M* = 1.57, *SD* = 0.74) dimension. Overall, it was found students were rated as good (i.e., 3 points) for the content selection, organization and multimedia design dimension. The interactivity dimension was rated as satisfactory (i.e., 2 points) while the originality dimension was rated as poor (i.e., 1 points).

Table 2 Results of the Curation Measure

DC / Scores	Content selection	Content organization	Content originality	Content interactivity	Multimedia design	Total
Mean (*SD*)	3.23 (0.69)	3.11 (0.63)	1.57 (0.74)	2.65 (1.05)	3 (0.81)	2.71 (0.99)

In the meantime, a one-way ANOVA test was conducted to examine any significant differences among the five dimensions of the Curation Measure. The analysis indicated a significant difference when comparing the mean scores between each dimension, $F(4, 170) = 24.97$, $p < .01$. Post hoc analysis using the Turkey HSD test further revealed that the originality dimension was significantly lower than the other four dimensions ($p < .05$). In addition, the content selection dimension was significantly higher than the interactivity dimension ($p < .05$). No other significant differences were obtained from the analysis. A visual comparison of mean scores among the five dimensions was presented in Figure 3.

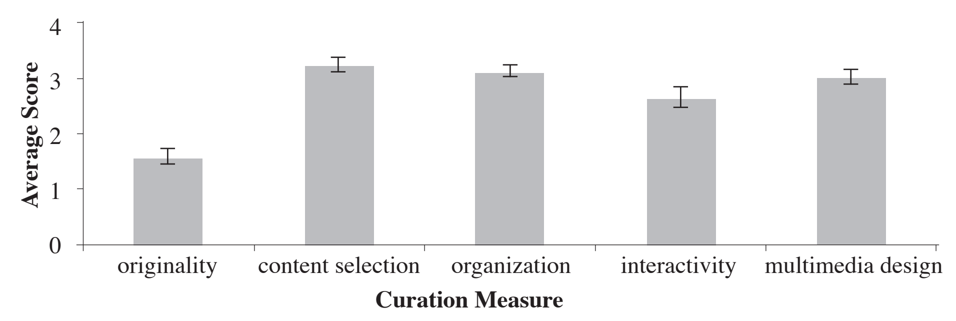


Figure 3 Differences in Mean Scores between Each of the Diemension of Curation Measure

Note: Error bars indicate the standard error of the mean.

Analysis of the Computation Measure

The result of the Computation Measure was presented in Table 3. The overall mean score for learning CT concepts was 2.81, which fell between satisfactory and good to the scoring rubric (see Appendix 2). Students achieved the highest mean score for the event concept ($M = 3.11$, $SD = 0.82$) and the lowest mean score for the variables concept ($M = 2.45$, $SD = 0.85$). Overall, students were rated as good (i.e., 3 points) for more simple concepts such as the sequence and event and satisfactory (i.e., 2 points) for more sophisticated concept such as the conditionals, variables and loops concept.

Table 3 Results of the Computation Measure

Scores \ CT concepts	Event	Sequence	Conditionals	Variables	Loops	Total
Mean (*SD*)	3.11 (0.82)	3.05 (0.76)	2.68 (0.87)	2.25 (0.85)	2.74 (0.74)	2.81 (0.84)

When further examined the differences in mean scores among the five CT concepts, a one-way ANOVA test showed a significant difference in mean scores, $F(4, 170) = 3.94$, $p < .05$. Post hoc analysis using the Turkey HSD test further revealed that both the result of event and sequence concept significantly outperformed the result of variables concept ($p < .05$). No other significant differences were obtained from the analysis. A visual comparison of mean scores among the five CT concepts was presented in Figure 4.

Correlation Analysis between Curation Measure and Computation Measure

To examine the interrelationship between the Curation Measure and Computation Measure, a Pearson correlation analysis was performed. The analysis results indicated a non-significant correlation between the Curation Measure and Computation Measure, $r = .286$, $p = .095$. However, further investigations on correlations between each of the dimension within the Curation Measure and the Computation Measure indicated a significant positive correlation

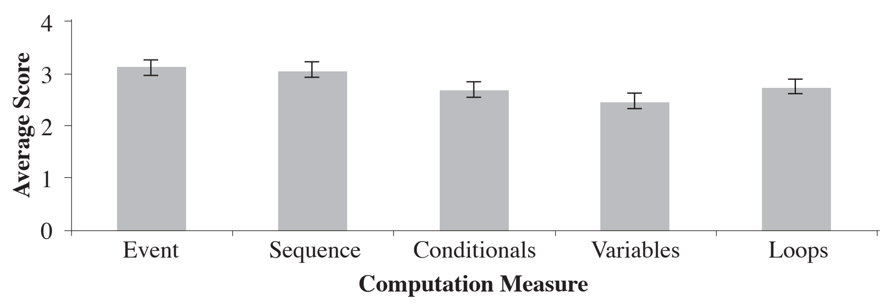


Figure 4 Differences in Mean Scores between Each of the Diemension of Computation Measure

Note: Error bars indicate the standard error of the mean.

under two conditions. In one condition, the analysis showed a significant positive correlation between the organization dimension of Curation Measure and the sequence concept of Computation Measure, $r = .535$, $p < .01$. In the other condition, the interactivity dimension of Curation Measure showed a significant positive correlation for the conditionals ($r = .779$, $p < .01$) and loops ($r = .598$, $p < .01$) concept. No other significant correlations were obtained from the analysis. Detailed results of correlation analysis between the Curation Measure and Computation Measure were presented in Table 4.

Table 4 Correlation Analysis between Curation Measure and Computation Measure

Computation measure \ Curation measure	Content selection	Content organization	Content originality	Content interactivity	Multimedia design
Sequence	$r = .316$ $p = .065$	$r = .535$ $p < .01$	$r = .032$ $p = .854$	$r = -.053$ $p = .763$	$r = -.104$ $p = .554$
Event	$r = .261$ $p = .130$	$r = .030$ $p = .862$	$r = -.061$ $p = .726$	$r = -.088$ $p = .615$	$r = -.132$ $p = .450$
Conditionals	$r = -.319$ $p = .062$	$r = -.309$ $p = .071$	$r = -.262$ $p = .128$	$r = .779$ $p < .01$	$r = .169$ $p = .333$
Variables	$r = .076$ $p =.701$	$r = .064$ $p = .715$	$r = -.287$ $p = .095$	$r = .376$ $p = .060$	$r = .129$ $p = .461$
Loops	$r = -.227$ $p = .190$	$r = -.124$ $p = .478$	$r = -.207$ $p = .233$	$r = .598$ $p < .01$	$r = -.049$ $p = .778$

Discussion

One might reasonably wonder why to investigate the interrelationship between the learning of CT and DC skills for children. Of course such skepticism was not completely unwarranted as the two skillsets appeared to vary by nature. In fact, this study was a reflection of previous research framework about teaching children CT practices with Scratch, in which researchers pointed out that children seemed more engaged in curating the multimedia content than in practicing the CT concepts during digital storytelling activities (Kafai et al., 2009). In other

words, when guiding children to design an interactive story with Scratch, there were possibilities that the learning of CT and the learning of DC could interfere with each other, which in turn caused difficulties not only in instructional design but also in the attributions of educational outcomes. Our findings, in contrast, suggested that the learning of CT was not mutually exclusive to the learning of DC for children. Instead, the two skillsets could compliment each other in a number of aspects, such as the organization of the story's plot helped student practice the sequence concept of CT; the curation of interactive elements of the story helped students articulate how to appropriately apply conditionals and loops constructs to the design of the story. The following paragraphs first explored the results and implications of Curation Measure and Computation Measure, followed by intensive discussions on the interrelationship between CT and DC skills.

Implications for Digital Curation Skills

The analysis of the digital curation (DC) project demonstrated that nearly 85% of the students completed a well-defined curation project using Scratch. Only 15% of students' Scratch projects lacked a theme that would connect personal experiences. In most students' projects, a cohesive sense of purpose was demonstrated. The percentage of completions was higher than expected because this workshop met only once a week for 10 sessions. When we investigated the types of curation projects, most were identified as narratives (60%) that had an articulated beginning, middle, and end for the reader to follow. Projects with an art gallery (18%) were the second most popular type; in them, students showcased their personal artwork. We found students were highly motivated to use the free drawing tools offered by Scratch to create their own clip art or audio recordings to convey their thoughts and ideas. A small number of students' curation works had a video game (7%), in which story ideas were transformed into either a contest or a puzzle with clearly defined game rules. Curation works that seemed to drift in many directions without a theme were categorized as other (15%).

Interestingly, though the same instructions and guidelines were given to all students, their curation projects varied greatly. Different children might have different perceptions about what constitutes a story. The variation in genres of curation also reflected the multimedia affordability and interactive elements offered by Scratch, which was consistent with findings in relevant studies (Kafai et al., 2009). Some students stayed focused on the narrative aspect of a story, others switched to the visual, aesthetic aspects of a story, and still others created entertaining elements for a story. To better illustrate how students curated an interactive story with Scratch, we summarized the core learning activities as a three-phase framework by referencing to the model proposed by Deschaine and Sharma (2015). First, DC began with active selection and filtering of

multimedia resources in Scratch, a process through which a student learned to collect and filter out irrelevant data using cognitive learning procedures, such as critical thinking, problem solving, and self-reflection (Harvey, 2010). Next, students delved into the organization, arrangement, and evaluation of multimedia resources. This required a student to form a solid mental representation of the content to be curated by meticulously aligning the audience's expectations with his or her conceptual design plans. In the final phase, students demonstrated the content to be curated by coordinating multimodal representations, such as texts, images, audio clips, and animations (Porter, 2004).

Exploration of the mean scores of the five dimensions of Curation Measure (i.e., originality, content selection, story organization, interactivity, and media effect) suggested that digital storytelling with Scratch contributed to the understanding of children's DC skills in general. Digital storytelling served as an effective vehicle that helped students construct their knowledge through the learning by doing immersion method of constructivism (Yang & Wu, 2012). Students demonstrated better curation skills in the dimensions of content selection and story organization than in other dimensions. These two skills were considered fundamental to DC, particularly with the use of digital technologies (Hobbs, 2011; Mihailidis & Cohen, 2013). Besides, post-hoc analysis showing a significant difference between the content selection dimension and the interactivity dimension implied that it was more difficult to curate the interactivity of a story with block-based coding tools (BCTs). The interactivity dimension should be perceived as an interdisciplinary skill because it might involve knowledge in other domains, such as computer science. Meanwhile, students' performance in the multimedia design dimension revealed that they endeavored to integrate various media elements into the content in order to enhance the sensational experiences for the audience. It is worth noting that students had the lowest mean score for the originality dimension. Apparently, this was due to the influence of the entertainment media to which children are exposed every day; a huge portion of students' curation projects were reproductions of cartoons, movies, comic books, or video games that they often encounter. This caused us to try to further understand the potential effect of the entertainment media on children's DC skills in the future.

Implications for Learning Computational Thinking Concepts

Students' learning of computational thinking (CT) concepts during storytelling activities was examined through the framework of the five CT concepts (i.e., sequence, event, conditionals, loops, and variables). Using the overall mean score (M = 2.81) as a cut-off value, we found that their performance in the event and sequence concepts was above the overall mean score, whereas their performance in concepts such as conditionals, variables, and loops was below

the overall mean score. This implied that students demonstrated an understanding of CT concepts more on the comprehension aspect than on the generation aspect (Robins et al., 2003). These findings were consistent with relevant studies in which children struggled with understanding more advanced CT concepts, such as conditional statement and recursion (Fessakis, Gouli, & Mavroudi, 2013), because they tended to be abstract and lacked concrete representations from which students could develop a good mental model of computational constructs when breaking down a problem into an action plan (Pea & Kurland, 1984; Shneiderman, 1980). The event and sequence concepts were easier to comprehend because they were simple in computational structure and complexity. Students were able to trace and monitor the consequences of their actions in relation to the story narratives. In sum, understanding abstract CT concepts depended not only on one's mental representation but also on the ability to break a problem down into manageable chunks with reference to the story's plot.

Because the learning of CT concepts revolved around digital storytelling activities, we further analyzed the five CT concepts related to functionality in storytelling. The sequence and event concepts served as the foundation of the story in which the student assigned the character's position on the stage and set up navigation buttons. In addition, the student had to coordinate the timing of conversations or scene transitions, actions that were not easy for novices to achieve. The conditionals and loops concepts were responsible for the cause-and-effect relationships in the story narratives. These two concepts outlined the logical path of the story's plot and controlled the conceptual flow of the story. Because conditionals and loops are abstract constructs that might cause misconceptions in learning (Kaczmarczyk, Petrick, East, & Herman, 2010), we found students struggled with the inclusion of these judgment statements into their story narratives. It was notable that most students knew where and when to place a conditional construct but they failed to correctly drag and arrange the appropriate building blocks that would enable the conditional construct. The variable concept functioned as either a sensor or a data container that allowed the storyteller to interact with the audience. As a sensor, the audience could input data with a keyboard to actively participate in or respond to the story narrative. As a data container, the storyteller could collect contextual data to provide customized feedback when needed.

The Interrelationship between CT and DC

The Pearson correlation analysis showed that the learning of CT concepts and the practice of DC appeared to develop independently of each other. There was no empirical evidence to support such a finding, because no previous studies had ever explored the interrelationships between the two abilities. Further

investigation of the interrelationship between each of the dimensions within the two skills, however, guided us to uncover a possible conceptual linkage between the two seemingly different knowledge domains. For instance, a significant, positive correlation was reported between the organization dimension of the DC skill and the sequence concept of CT. This could be explained by the similarity between the two concepts because both of the evaluation criteria concentrated on the structural progression of a story. The organization dimension of DC evaluated students' abilities to organize the progression of a story plot. Likewise, the sequence concepts of CT examined students' ability to use the computational construct to support the ordering of events in a story. If a story had a well-organized structure during the process of DC, it would become easier for the storyteller to articulate the design of the computational constructs. To put it differently, the organization dimension represented the ability to conceptually organize a story, whereas the sequence concept represented the pragmatic skills needed to carry out the conceptual design plans. In this regard, a student's performance of CT skills could be explained by the student's performance of DC skills. A similar rationale was seen in the interactivity dimension of DC, where a significant, positive relationship was identified with the conditionals and loops concepts of CT. Given the fact that the design of both the conditionals and loops constructs controlled and determined the interactive mechanism of a story, it was reasonable that they would be significantly correlated with each other.

Henceforth, we argued that the learning of CT concepts and the practice of DC were in fact closely related to each other when engaging children in digital storytelling with a BCT such as Scratch. DC through digital storytelling could facilitate the learning of CT concepts under certain conditions. Additionally, the learning of CT and DC concepts could be perceived as a process of mental model construction through learning by doing. One's curation work could be perceived as a mental representation of a particular topic (Wolff & Mulholland, 2013) while one's understanding of a CT concept could be perceived as a mental representation of an abstract computational construct. These findings also shed light on instructional design practices in the sense that the learning and teaching of CT and DC skills should be regarded as one interdisciplinary skill that can be acquired by children. A common criticism of teaching novices computational constructs such as conditionals and variables is the lack of a rich, contextualized description of CT concepts (Gries, 2006; Gomes & Mendes, 2007; Veerasamy, D'Souza, & Laakso, 2016). The practice of DC, however, overcomes this drawback by situating students in a learning context where they can reflect on their personal experiences. Thus, the learning and teaching of abstract CT concepts, regardless of their functionality and complexity, should be framed in DC activities such as

storytelling to more effectively motivate a student. In other words, the ideas of DC could serve as a road map that can guide the learning of CT concepts.

Conclusion

This study aimed to understand the interrelationship between children's learning of CT concepts and the practice of DC because the learning of computational constructs seemed to overlap with the notion of curating a story. From analysis of the Curation Measure, we found students were most engaged in the content selection and story organization activities. Significant differences in mean scores between the five dimensions guided us to recognize students' insufficient knowledge when curating a story with Scratch. From analysis of the Computation Measure, students' learning performances were consistent with the level of difficulty of each CT concept. Though no significant difference was found in mean scores for each of the five CT concepts, students tended to struggle with integrating the more abstract, complex CT concepts (i.e., conditionals, loops, and variables) into digital storytelling activities. Further investigations revealed a significant, positive correlation between the content organization dimension and the design of sequence concept in CT. In addition, the content interactivity dimension was significantly correlated with the design of conditionals and loops constructs of CT. These findings led to an interdisciplinary collective perspective on the assessment of a student's learning of CT and DC practices. It was hoped that the learning of CT concepts would manifest itself in context of DC while the practice of DC would be strengthened by the inclusion of computational constructs.

There were a number of limitations in this study, and, based on these, further research suggestions were proposed as follows. One limitation of this study was the selection of CT concepts as we only focused on the five fundamental concepts. Further studies might expand the research scope by including more complex computational constructs to curate an interactive story. Next, since there were no Internet connections throughout the workshop, we didn't explore the content circulation aspect of DC skills. Further studies might attempt to investigate how students publish their Scratch curation projects online and reflect on the collected feedback to enhance their DC skills. A third limitation was the time and scheduling constraints. The study took place only once a week for 10 sessions whereas more frequent learning experiences and a longer duration of activities could result in finding more profound interrelationships between CT and DC. Lastly, though the same instructions were given to all students, we did not explicitly restrict the genre of the curation project to be a narrative story or not. Variations among different genres of DC might lead to different conclusions when

interpreting the data. Future studies might seek to narrow down the scope by peeking into the interplay between CT and DC skills based on a particular genre of curation project.

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Appendix 1

Curation Measure Scoring Rubric

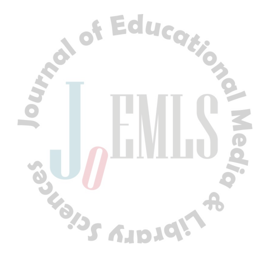
Category \ Points	0 (Unacceptable)	1 (Poor)	2 (Satisfactory)	3 (Good)	4 (Excellent)
Content Selection	No specific theme of curation was defined.	A theme could be roughly identified and the content lacked coherence.	A theme was clearly identified but not well-maintained.	A theme was clearly identified and mostly maintained a focus.	A theme was clearly identified with a coherent focus throughout the curation.
Content Organization	A beginning, middle or end of the story was missing. No important plot elements.	Part of a beginning, middle or end of the story was created. No important plot elements.	A clear beginning, middle and end were created. No important plot elements.	A clear beginning, middle and end were created with some important plot elements.	A clear beginning, middle and end were created with all plot elements in detail.
Content Originality	The content was not original at all.	The content was partially original with minimal modifications.	The content was partially original with major modifications.	The content was original and uniquely presented.	The content was original and exceptionally unique.
Content Interactivity	No interactive story narrations were added.	Attempted to add interactive story narrations but didn't match the story's plot.	Interactive story narrations were created to match some parts of the story's plot.	Interactive story narrations were created to match most parts of the story's plot.	Interactive story narrations were properly created for the entire story's plot.
Multimedia Design	No multimedia element (i.e., visual effects, animations or sound clips) was seen.	Added multimedia elements but the design of effect was not understandable.	Multimedia elements were adequately added to enrich some parts of the story.	Multimedia elements were correctly added to enrich most parts of the story.	A well-planned selection of multimedia element was made to enrich the whole story.



Appendix 2

Computation Measure Scoring Rubric

Concepts \ Points	0 (Unacceptable)	1 (Poor)	2 (Satisfactory)	3 (Good)	4 (Excellent)
Event	No event blocks were found on the stage.	Dragged event blocks but attached nothing to them.	Added event blocks but were attached to the incorrect characters.	Correctly added event blocks to characters but had redundant blocks.	Correctly added event blocks without any errors.
Sequence	No sequence blocks were found on the stage.	Dragged sequence blocks but attached nothing to them.	More than 3 programming errors were found for the sequence blocks.	Only 1-3 programming errors were found for the sequence blocks.	Correctly added sequence blocks without any errors.
Conditionals	No conditionals blocks were found on the stage.	Dragged conditionals constructs but attached nothing to them.	More than 3 programming errors were found within the conditional constructs.	Only 1-3 programming errors were found within the conditional constructs.	The conditionals constructs were correctly created without any errors.
Variables	No variables blocks were found on the stage.	Created variables blocks but attached nothing to them.	More than 3 programming errors were found within the variables construct.	Only 1-3 programming errors were found within the variables construct.	The variables construct was created correctly without any programming errors.
Loops	No loops blocks were found on the stage.	Dragged loops blocks but attached nothing to them.	More than 3 programming errors were found within the loops construct.	Only 1-3 programming errors were found within the loops construct.	The loops construct was created correctly without any errors.



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研究論文

兒童學習運算思維概念與數位策展能力的關聯性研究初探

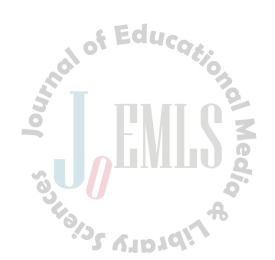
張君豪

摘要

透過Scratch進行數位敘事，是培養兒童運算思維常見的教學模式。兒童在透過數位敘事學習運算思維概念時，也同時啟發了數位策展能力的培養，但在學習成效評測時，相關研究多聚焦於運算思維概念而非數位策展能力，對於兩種能力間的互動關係也缺乏探究。鑑於此，本研究以紐約市35位五年級生為例，在10週的學習中，剖析他們使用Scratch設計互動故事時，在運算思維概念與數位策展能力之間的學習成果，並針對運算思維的五個子概念與數位策展的五個子維度，進行相互的關聯性分析。統計結果顯示，雖然運算思維概念與數位策展能力整體而言並無顯著關聯性，但在子維度的分析上，發現數個具有顯著關聯性的情境，可供教學設計時參考。

關鍵詞：運算思維，數位策展，數位敘事，Scratch，K-12教育

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研究論文

應用ePUB3電子書於翻轉式寫作課程設計與教學實務：以摘要寫作為例

蔡娉婷[a*]　許慶昇[b]　林至中[c]

摘要

本文探討如何應用新興的ePUB3電子書技術於寫作課程的翻轉式學習，並提出以翻轉式混合學習為基礎的寫作課程設計流程，使課程教案與教材能充份運用ePUB3電子書的優點，將教材內容透過適當的翻轉式學習活動傳遞給學生。接著，本文運用此流程於某大學通識課程「摘要寫作」單元的教學與評量，並經由實際教學、準實驗研究法對照分析，以及學生滿意度調查與感想訪談，以驗證應用翻轉式混合學習模式與ePUB3電子書於寫作教學的有效性及學生滿意度。研究結果顯示，本文所提出的寫作課程設計流程，透過翻轉式混合學習模式與ePUB3電子書的應用，可提升學生的摘要寫作學習成效，且學生亦相當滿意此種方式進行學習。

關鍵詞： 寫作教學，翻轉學習，課程設計，ePUB3電子書，準實驗研究法，教學評量

前　言

有關線上學習的管理機制，以及相關資訊系統的研究，已經成為近年來的熱門研究課題，各大學亦紛紛推出Moodle[1]、iLearn[2]等數位學習平台，使學生可以透過放置於平台的數位內容進行學習。此外，遠距方式的輔助學習管道如磨課師（MOOCs；磨課師分項計畫辦公室，2017）等亦愈來愈普及，使得學

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習管道與方式更擴展至無遠弗屆。從學習角度看，這代表著課程內容是依據學習活動順序、透過適當方式傳遞給學習者，以達到預期的學習成效，相關研究已非常多（周君倚、陸洛，2014；鄭鈺霖、黃天麒、黃悅民，2008；Stone & Zheng, 2014）。

此外，為因應教育的發展趨勢，各大學亦已開始調整授課方式為混合式課程，混合式學習（亦即blended learning；Bonk & Graham, 2006）已在國外成為倍受矚目的學習方法，其重點是將數位學習整合到教育系統之中，也就是善用網路與科技、並搭配合適的師生面對面互動，以提升教與學的效率（Alonso, López, Manrique, & Viñes, 2005; Bersin, 2004; Thorne, 2003），主要原因即為學生在課堂的學習參與提高，顯著改善了學生因上課無聊而曠課的情況。

有鑒於ePUB3電子書的強大功能（例如多樣化版面、多媒體嵌入、互動性功能以及動態式呈現等；International Digital Publishing Forum, 2011），筆者自105學年度第2學期（2017年2月）起，將部分教材製作成ePUB3電子書，並透過實務教學與評量，以驗證應用ePUB3電子書於寫作教學的成效。於此同時，也開始進行ePUB3電子書教材製作、課程設計、彈性式／翻轉式混合學習模式等議題探討，並已獲得初步的研究與實證成果。基於過去這一年的ePUB3電子書教學研究與實務經驗，筆者深切感受到應用ePUB3電子書於教學的效用，但對於應用ePUB3電子書於翻轉式學習，則仍發現目前已完成的研究與實務成果尚有許多待改進之處，其主要問題為教材內容尚無法完整配合翻轉學習的多元化活動進行，並透過合適方式傳遞給學生。

為此，本研究將針對上述的限制，探討如何應用翻轉式混合學習模式與ePUB3電子書於寫作教學，使教材能運用ePUB3電子書的優點，將內容透過適當的翻轉學習活動，以多樣化方式傳遞給學生。也由於本研究以應用ePUB3電子書於翻轉式混合學習為核心，因此將針對以下三點詳加探討：㈠翻轉式混合學習模式下，寫作課程應有之學習活動（也就是在翻轉式混合學習模式下，寫作課程應如何進行）；㈡寫作課程教材內容的ePUB3電子書設計與製作，以配合學習活動的進行；以及㈢嵌入於此寫作課程電子書的ePUB3功能規劃與實作，以完成學習活動的各項動作進行與教材內容傳遞。

據此，本研究設定有以下兩個研究問題：

研究問題1：應用翻轉式混合學習模式與ePUB3電子書於寫作教學的學習成效是否優於傳統翻轉教學方式的學習成效？

研究問題2：學生對於運用翻轉式混合學習模式與ePUB3電子書於寫作學習的滿意度及感想為何？

因此，本研究的目的為針對上述兩個研究問題，提出一個應用ePUB3電子書於翻轉式混合學習的寫作課程設計流程，運用ePUB3電子書的強大功能，改善傳統翻轉式寫作學習方案的許多限制，增加學生的學習成效及滿意度。

最後，本研究將運用所提出的課程設計流程於某大學通識教育課程「摘要寫作」單元的實際教學與評量，並經由準實驗研究法的實驗組及控制組對照分析，以及學生的滿意度調查及感想訪談，以驗證上述兩個研究問題。

本文將於第二節，針對本研究的相關課題，做背景介紹及研究動機說明。接著在第三節，說明研究設計、研究對象、研究工具與研究流程，並在第四節，運用此流程於實際教學與評量，並透過準實驗研究法的對照分析，以及學生的滿意度調查及感想訪談，以驗證本研究的學生學習成效及滿意度。第五節則為結論與未來展望。

二、研究背景與動機

㈠翻轉式混合學習

一項由美國新媒體聯盟（New Media Consortium，簡稱NMC）2016年調查製作的報告地平線報告：高等教育版（*Horizon Report: Higher Education Edition*；老頑童，2016）所揭示未來高等教育將面臨的關鍵趨勢、重要挑戰，以及對於科技應用的重要發展，認為未來的影響趨勢為：持續重視學習評量（growing focus on measuring learning），以及加強使用混合式學習（increasing use of blended learning）。這篇報告並提到，為因應教育的發展趨勢，各大學已開始調整授課方式為混合式課程；其中，澳洲西雪梨大學已於2016年將大學部課程全部改為討論式混合式教學，而美國賓州Peirce College採用混合式教學後，曠課率由10.2%降至1.4%，主要原因即為學生在課堂的學習參與提高，顯著改善了學生因上課無聊而曠課的情況。因此，混合式學習（Bonk & Graham, 2006）已在國外成為倍受矚目的學習方法。

此外，依據數位學習佔教學比例的多寡，混合式學習的實施模式主要可以分為以下幾種（顧大維，2010；鄒景平，2003；Educational Technology and Mobile Learning, 2014; McGee & Reis, 2012; Thompson, 2016）：

1.翻轉模式（flip model）：運用科技以翻轉上課時學生與老師的角色，鼓勵學生課前依自己時程規劃預讀教材內容，之後於教室上課時、由學生自行提出或由老師指定題目以進行討論，並視需要由老師進行補充說明的混合學習模式。

2.轉動模式（rotation model）：學生上課時依時程規劃於教室內不同地點輪流進行學習，其中至少一個地點是運用科技的線上學習，而其餘地點則可結合直接教學、小組討論、個別輔導等方式進行學習。

3.彈性模式（flex model）：學生上課時於教室內以自己時程規劃線上閱讀教材內容，老師則督導完成其餘課程相關工作，例如練習、測驗、問卷等；此外，老師也可視情況進行教材內容的補充說明或針對個別學生從旁加以指導。

4.遠距模式（online driver model）：以線上傳遞方式進行遠距教學，例如近年來極為普及的磨課師（MOOCs）課程教學。

目前，在上述各個混合式學習實施模式中，翻轉模式可說是最常見的學習模式（Chen & Chen, 2014; Chu & Yang, 2017; Kim & Ahn, 2018; Pugsee, 2017; Ram & Sinha, 2017; Roehl, Reddy, & Shannon, 2013; Wen, Zaid, & Harun, 2016; Zhang, Meng, Han, Yuan, & Wang, 2016），其以學生為核心的教學理念，不僅能提升學生的學習興趣，更能透過自行閱讀教材及參與課堂活動、提高學生自主學習的能力。例如，Chen與Chen（2014）提出一個整體翻轉課堂方案（holistic flipped classroom，簡稱HFC），以提供學生一個完整的翻轉學習環境，使其能在學習活動中方便的閱讀教材及參與課堂活動。此外，Ram與Sinha（2017）提出一個翻轉課堂模型（flipped classroom model，簡稱FCM），使教材閱讀能與學習活動配合，並搭配Moodle 學習平台以便於這些學習活動順利進行。最後，Wen等（2016）強調在翻轉學習活動中運用社群網路互動及特定教學方法，以提高學生的學習效率。

此外，國內多所高中職導入於教學的PaGamO[3]、1know[4]等遊戲式線上學習平台，及各大學紛紛採用的Moodle、iLearn、Zuvio[5]等數位學習平台，皆可使學生透過放置平台的數位內容進行學習，實踐翻轉的學習模式。

㈡ ePUB3電子書

在學習系統裡，透過適當方式將教材內容傳遞給學生，將可增進其學習興趣、提高其閱讀意願。目前已有許多教材內容傳遞機制，包括網際網路（internet）、多媒體（multimedia）、社群媒體（social media），以及虛擬／擴增實境（virtual/augmented reality）等（Bermejo, 2005; Blank, Roy, Sahasrabudhe, Pottenger, & Kessler, 2003; Bressler & Bodzin, 2013; Caeiro-Rodríguez, Pérez-Rodríguez, García-Alonso, Manso-Vázquez, & Llamas-Nistal, 2013; Chen & Chen, 2014; Clark & Mayer, 2011; Gao & Liu, 2010; Lee, Chen, & Chang, 2016; Mao, Sun, & Chen, 2017; Martens, Gulikers, & Bastiaens, 2004; Ram & Sinha, 2017; Romero-Hall, Watson, Adcock, Bliss, & Tufts, 2016; Wen et al., 2016; Zhang et al., 2016）。

此外，標準化的ePUB3格式（International Digital Publishing Forum, 2011）也於2011年被制定出來，以提供數位內容出版及交換的標準規格，其運用了HTML5、CSS、JavaScript等機制，規範出數位內容的呈現、結構、以及互動多媒體等特性，透過強化的數位內容語法及語意內涵，達成標準規格的完整性及單一化。因此，ePUB3已被廣泛使用於電子書（eBook）的內容格式（也可稱

[3] https://www.pagamo.org/

[4] http://1know.net/#!/

[5] http://www.zuvio.com.tw/

為ePUB3電子書），而其豐富的功能性格式規範，例如多樣化版面、多媒體嵌入、互動性功能，以及動態式呈現等，更能滿足不同領域的出版需求。現今，ePUB3電子書也開始受到教育界所重視，以期待透過其功能強大的格式規範，提供更便利的學習活動進行與教材內容傳遞環境。

另外，需特別注意的是，有關電子書的內容格式，目前已有許多正在使用的格式，例如DAISY[6]、ePUB[7]、iBook[8]、KF8[9]，以及PDF[10]等。然而，在這些格式中，本研究將著重於ePUB3的使用，主要是因其提供的強大功能，例如其採用的HTML5機制可提供相當豐富的多樣化版面，而JavaScript元件可提供完整的互動性功能；此外，ePUB3是開放式格式，且支援多國語言（例如，日文、韓文，以及繁／簡體中文），也因此已獲國際標準組織ISO/IEC JTC 1/SC 34認證為國際性通用標準電子書格式ISO/IEC TS 30135（International Organization for Standardization, 2014）。

㈢ 應用ePUB3電子書於寫作教學的思考

近年來，教育部為鼓勵大學校院強化學科專業課程的表達溝通訓練，十分注重學生涵攝學科知能的綜合敘事能力，包括工作適應、語言表達、團隊溝通等能力，皆屬於大學生畢業後進入職場所不能或缺的「軟實力」。此外，教育部於2018年起推動高教深耕計畫，鼓勵教師創新教學，自我檢視教材內容，秉持實用主義的態度，與時俱進，並透過系統化方法有效運用學習理論。因此本研究所探討的應用ePUB3電子書於寫作教學，便是針對此一潮流所做的創新教學。如前節所述，ePUB3電子書不同於傳統的靜態文件，不僅提供便利的閱讀，更能透過豐富且多樣化的功能，滿足教育領域所需要的便利學習活動進行與教材內容傳遞環境，例如：1.可使教學環境具有生動性、互動性，以及娛樂性；2.可使教材內容具有知識性、回應性，以及報酬性；3.可使教材內容的傳遞具有時間性、順序性、位置性，以及重覆性。

一般而言，寫作是應用中文的核心能力之一，大學應用中文寫作課程的特色，多以培養學生的重點剖析、事理敘述、情境設計等能力為主，因此所規劃開設的課程多包含「筆記、摘要」（重點剖析）、「書信、新聞、公文」（事理敘述）、「企劃、劇本」（情境設計）等單元。也由於這些單元性質不同，教材與教法必須活化、創新，方能引起學生的注意與興趣、並進而提升其參與學習的意願。目前國內已有許多大學致力於推廣學生的寫作能力，紛紛成立與語

[6] http://www.daisy.org/

[7] http://idpf.org/epub

[8] https://discussions.apple.com/community/notebooks/ibook

[9] https://www.amazon.com/gp/feature.html?ie=UTF8&docId=1000729511

[10] https://acrobat.adobe.com/tw/zh-Hant/acrobat.html?promoid= C12Y324S&mv=other

文或寫作能力有關的專責單位，例如靜宜大學的「閱讀書寫中心」、清華大學的「寫作中心」、台北醫學大學的「反思寫作中心」，以及逢甲大學的「國語文研究中心」。而教育界更已有許多使用翻轉學習做為寫作課程教學方法的經驗（王憶貞，2018；張輝誠，2015；張璨月，2011；凱多，2015；薛羽珊，2018；雷由禮，2018），以學生為核心、鼓勵學生課前預讀教材、上課時再透過議題討論完成深度學習。教學評量結果也顯示，使用翻轉學習的確可提升學生的寫作學習成效，且學生亦滿意使用此種方式進行學習。

然而，這些現有的寫作課程翻轉學習方案，仍然存在許多限制，例如多以學生翻閱課本或觀看影片等方式學習，教師則使用數位學習工具（如學習平台、行動裝置等）進行教學，此種方案不僅受限於使用的課本或影片等傳統寫作教材，屬於單向內容傳遞、缺乏多媒體及互動等功能，對於學生較無閱讀的吸引力，更由於教材內容並未配合學習活動透過合適方式傳遞給學生，使得學生不易於學習活動進行時依本身狀況彈性學習教材內容，從而降低其參與學習活動的意願。因此，如何運用快速發展的數位科技以創新教材與教法、改善傳統教材的限制、輔助寫作課程的教學與學習，就成為近年來相當受到教育界重視的一個課題。

本研究所將探討的，以應用ePUB3電子書於翻轉式混合學習為核心的寫作課程設計，即針對此課題而提出，將以McGee與Reis（2012）所討論的混合式學習課程設計規範，以及知名的ASSURE混合式學習方案（Smaldino, Lowther, & Russell, 2012）為基礎，除參考現有翻轉學習模式的特色（Chen & Chen, 2014; Ram & Sinha, 2017; Wen et al., 2016），也另再針對翻轉式寫作學習活動、落實學習活動的電子書教材設計（蔡娉婷，2018），以及ePUB3功能嵌入等部分加以擴充，使教案與教材能充分運用ePUB3電子書的優點，將教材內容透過適當翻轉式學習活動，以ePUB3電子書的豐富樣式傳遞給學生，以增加其學習興趣，強化其對課程內容的了解，進而提升其學習成效。

因此，基於以上思考，本研究將以ePUB3電子書以及翻轉式混合學習為核心，針對以下三點加以考量：

1.為倡導以學生為核心的教學理念，以及提升學生自主學習的能力，本研究將採用翻轉式混合學習模式於寫作教學，並探討在此學習模式下，寫作課程應有之學習活動，以及在翻轉式混合學習模式下，寫作課程應如何進行。如同前文所述，翻轉式混合學習非常鼓勵學生課前依自己時程規劃預讀教材內容，以培養其自主學習能力；之後於教室上課時，可藉由學生自行提出問題或由老師進行補充說明，落實以學生為核心的學習模式。而為達成課程的學習目標，如何運用適當的學習理論（theories of learning; Ally, 2004; Hoic- Bozic, Mornar, & Boticki, 2009）以規劃學習活動內容，將成為此工作的重點。具體而言，研究顯示（Johnson & Aragon, 2003; Mishra, 2002），良好的學習活動內容皆會採用學習

理論中的主要三個理論：行為理論（behaviourism）、認知理論（cognitivism），以及建構理論（constructivism），而其中建構理論又最為教育界採用（Morphew, 2000），這主要是因建構理論強調以學生為主體、老師輔導學習的教學理念。因此，本研究將探討如何適當運用這三個學習理論，以完成寫作課程的學習活動內容規劃，以提供學生優質的學習環境。

2.接著，本研究將探討寫作課程的ePUB3電子書教材內容，此部分將以配合學習活動的進行為基礎，落實學習活動採用的學習理論為核心，完成寫作課程的ePUB3電子書教材內容設計，使教材內容能配合學習活動的進行，透過ePUB3電子書的豐富樣式傳遞給學生，增加其學習興趣，強化其對課程內容的了解，進而提升其學習成效。

3.最後，本研究將探討此寫作課程的ePUB3電子書功能設計，由於ePUB3具有豐富的功能性格式規範，例如多樣化版面、多媒體嵌入、互動性功能，以及動態式呈現等，因此如何運用這些功能性格式於此電子書（也就是如何嵌入這些功能於此電子書），以實作出配合學習活動進行與落實教材內容傳遞的功能，就成為此工作的重點。具體而言，ePUB3所能提供的、可被嵌入於此電子書的功能（Lin, Tsai, Lin, & Li, 2017），除一般性文字與圖片外，尚有影片、參考連結、語音導讀、自動輪播、作業練習、分組討論，及測驗等。

據此，本研究透過以上三點考量，將可提供學生優質的翻轉式混合學習歷程，透過便利的學習活動進行及教材內容傳遞環境，增加學生學習寫作的興趣，並進而提升其學習的成效。最後，有關實務驗證部分，本研究將運用所提出的翻轉式混合學習課程設計流程於106學年度第1學期（2017年8月）某大學通識課程「摘要寫作」單元的教學與評量，並經由實際教學、準實驗研究法的對照分析，以及學生的滿意度調查及感想訪談，以驗證應用翻轉式混合學習模式與ePUB3電子書於寫作教學的學生學習成效及滿意度。

三、研究方法

㈠研究設計

本研究係以前後測量不等組準實驗設計為主，封閉式問卷調查及開放式面對面訪談為輔，探討應用翻轉式混合學習模式與ePUB3電子書於摘要寫作課程的教學成效，實驗設計模式如圖1所示。

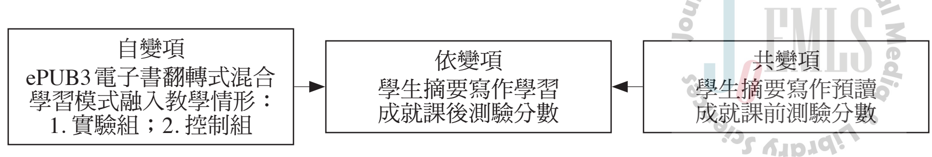


圖1 研究架構圖

其中自變項為翻轉式混合學習模式與ePUB3電子書融入教學情形，實驗組採用實驗處理、也就是將ePUB3電子書翻轉式混合學習模式融入教學，而控制組則不採用此實驗處理的傳統翻轉學習方式，也就是設計與實驗組相同的學習活動，但使用內容與實驗組相同的傳統紙本及影片教材，因此學習活動進行方式也由（實驗組的）線上操作ePUB3電子書以完成教材閱讀、分組討論，以及成就測驗等活動，改為傳統的紙本閱讀及測驗、面對面討論等方式進行。

㈡研究對象

以本研究所探討的「摘要寫作」單元教學與評量而言，其授課對象為某大學大一學生，並未接受過專業寫作訓練及具備先備知識。課程評量部分則包括三項評量工作：1.準實驗研究法的實驗組及控制組對照分析，以驗證應用翻轉式混合學習模式與ePUB3電子書於寫作教學的學生學習成效；2.問卷調查以了解學生對課程的滿意度，以及3.面對面訪談以了解學生對課程的感想。因此，基於採用準實驗研究法、運用實驗組及控制組對照的質性與量化分析，本研究有以下研究對象：

1.實驗組，為該大學通識教育大一學生，43人，年齡為18至20歲之間，將接受ePUB3電子書翻轉式學習模式。

2.控制組，為該大學通識教育大一另外某班學生，47人，年齡亦為18至20歲之間，將接受不採用ePUB3電子書的傳統翻轉式學習模式。

3.實驗組與控制組學生入學背景、分數、年齡皆相當接近，且皆未修習過摘要寫作相關課程，因此所具備的摘要寫作先備知識及能力皆相當有限。此外，兩組學生皆未曾接受翻轉學習以及使用ePUB3電子書的經驗。

㈢研究工具

1.摘要寫作預讀成就課前測驗

在課前測驗（前測）部分，係以測試學生對於摘要寫作的概念為主，因此以選擇題命題，由筆者與其他兩位曾授過此課程的專業教師根據教學目標以及課程內容來命題（10題選擇題），並透過難易度（高／低分組答對比例的平均值）以及鑑別度（鑑別度指數）的分析，以驗證這10題的難易度以及鑑別度。為了進行試題分析，本研究以28位曾修過本課程的學生來實施檢測，並根據難度P、鑑別度D等指標進行試題篩選，檢測後的資料分析結果如表1所示，其中高分組為分數排名前27%者，低分組則為分數排名後27%者。試題難度P的篩選標準為：$.2 \le P \le .8$（$P < .2$代表試題偏難，$P > .8$代表試題偏易）；鑑別度D的篩選標準為：$D \ge .3$。根據以上標準，本研究的前測試題篩選方法為：鑑別度通過篩選標準，且難度值介於 .2至 .8。據此，扣除A3、A9、A10等三題過於困難或容易、鑑別度不佳的題目，課前測驗命題共採用了7題，以了解學生的預讀成效（也就是對於摘要寫作的概念）。

表1　ePUB3電子書摘要寫作單元課前測驗題目難易度及鑑別度分析

題號	高分組答對率（PH）	低分組答對率（PL）	難度（P）	鑑別度（D）
A1	1.000	.500	.750	.500
A2	0.875	.300	.588	.575
A3	1.000	.800	.900	.200
A4	1.000	.600	.800	.400
A5	0.875	.400	.638	.475
A6	0.750	.200	.475	.550
A7	0.875	.500	.688	.375
A8	0.875	.200	.538	.675
A9	1.000	.700	.850	.300
A10	0.375	.000	.188	.375

2. 摘要寫作學習成就課後測驗

至於課後測驗（後測）部分，由於以驗證摘要寫作的綜合應用為主，因此以問答題命題，由筆者與其他兩位曾教授過此課程的專業教師根據教學目標以及課程內容加以命題（1題綜合應用問答題，內容為老師指定一篇微小說，學生進行閱讀，並寫出5個關鍵詞及100字以內摘要），以驗證學生的學習成效（也就是對於摘要寫作的綜合應用能力），並於測驗後以評量尺規（rubics）做為評量標準（如表2所示），分別針對「內容掌握度」、「文句流暢度」與「關鍵詞選定」進行評量。為驗證後測試題評量尺規的穩定性，本研究以13位曾修過本課程的學生進行後測題目的檢測，並由筆者與其他兩位命題教師根據評量尺規進行評分，接著再以肯德爾W檢定（Kendall's W Test）驗證評分者間的信度（scorer reliability）。根據表3的肯德爾W檢定結果可知，無論在「內容掌握度」、「文句流暢度」，或「關鍵詞選定」等評分項目上，其漸進顯著值皆小於 .05；因此，在顯著水準為 .05的情況下，本評量尺規在不同評分者之間具有顯著穩定性。

表2　ePUB3電子書摘要寫作單元課後測驗評量尺規

項目	極佳	佳	可	欠佳
內容掌握度（40%）	36-40（完全掌握）	31-35（適當掌握）	26-30（部份掌握）	00-25（欠缺掌握）
文句流暢度（35%）	31-35（極為流暢）	26-30（相當流暢）	21-25（尚屬流暢）	00-20（欠缺流暢）
關鍵詞選定（25%）	23-25（極為精準）	20-22（相當精準）	17-19（尚屬精準）	00-16（欠缺精準）

表3　ePUB3電子書摘要寫作單元課後測驗評量尺規評分者間信度之肯德爾W檢定結果

	內容掌握度	文句流暢度	關鍵詞選定
個數	3	3	3
Kendall's W檢定[a]	.698	.655	.698
卡方	25.131	23.580	25.135
自由度	12	12	12
漸近顯著性	.014	.023	.014

[a]Kendall和諧係數

3. 問卷調查

有關學生對於使用ePUB3電子書教材進行摘要寫作學習的成效自我評量，本研究於實驗組上課結束後，以問卷調查方式進行。此問卷調查針對電子書以及翻轉式混合學習的使用，共設計有9題選擇性題目（如表4所示），分為三類：⑴使用ePUB3電子書；⑵使用翻轉式混合學習模式；⑶整體滿意度。而尺規部分則採用7等級的李克特量表（seven-point Likert scale），其中最低等級為「非常不好」（得0分）、而最高等級為「非常良好」（得6分）。

表4　ePUB3電子書摘要寫作單元滿意度問卷調查題目

題目性質	題目內容
使用ePUB3電子書	Q1. 跟傳統的紙本書籍比較，使用ePUB3電子書，是否讓你覺得學習上更有效率？
	Q2. 第3頁中針對摘要寫作的三個步驟，使用小動畫方式重複播放，是否讓你覺得更易記住摘要寫作的三個步驟順序？
	Q3. 第5頁的「摘要寫作實例㈠：刪字」，使用小動畫方式重複播放減省文字的練習，是否讓你覺得更易理解摘要寫作的掌握重點、刪除多餘相似詞的過程？
	Q4. 第9頁中針對摘要在語言的應用，使用影片播放搭配小測驗方式，以練習如何減省語言描述，是否讓你覺得更易學習如何應用摘要寫作？
使用翻轉式混合學習	Q5. 跟傳統上課方式比較，使用翻轉式混合學習模式上課，是否讓你覺得更有學習效率？
	Q6. 跟傳統上課方式比較，使用翻轉式混合學習模式上課，是否讓你覺得更以你為核心、提供你更能自己掌控學習的學習環境？
整體滿意度	Q7. 跟傳統上課方式比較，使用翻轉式混合學習模式以及ePUB3電子書上課，是否更能提高你的學習興趣？
	Q8. 跟傳統上課方式比較，使用翻轉式混合學習模式及ePUB3電子書上課，是否更能提高對課程內容的了解，進而提升學習成效？
	Q9. 跟傳統上課方式比較，你會優先選擇採用翻轉式混合學習模式以及ePUB3電子書上課的課程嗎？

4. 面對面訪談

有關學生對於使用ePUB3電子書教材進行摘要寫作學習的感想訪談，本研究也於實驗組上課結束後，以面對面方式進行。此面對面訪談採用系統抽樣法（systematic sampling），以學生名單「每5」（every 5th）取樣方式，從43名學生選取8名（編號#1至#8）進行訪談。如同問卷調查，此訪談針對電子書以及翻轉式混合學習的使用，設計有8題開放式問答題，分為三類：⑴使用ePUB3電子書；⑵使用翻轉式混合學習模式；⑶整體感想，如表5所示。

㈣ 研究流程

由於本研究以應用ePUB3電子書於翻轉式混合學習為核心，因此所提出寫作課程設計流程，將以現有許多翻轉式混合學習研究成果為基礎，另外再針對翻轉式寫作學習活動、落實學習活動的電子書教材設計，以及ePUB3功能嵌入等部分加以擴充，有以下五個步驟（此流程以完成ePUB3電子書翻轉式寫作課程的實施為目的，自確認寫作課程的學習目標開始，經由學習活動的規劃以及電子書教材的設計與製作，於完成實際的授課與評量後結束）。

表5　ePUB3電子書摘要寫作單元面對面訪談題目

問題性質	問題內容
使用ePUB3電子書	Q1. 跟傳統紙本書籍比較，你覺得使用ePUB3電子書學習是否更方便？為什麼？
	Q2. 跟傳統紙本書籍比較，你覺得使用ePUB3電子書學習是否更有效率？為什麼？
	Q3. 跟傳統紙本書籍比較，你覺得使用ePUB3電子書的優缺點是什麼？
使用翻轉式混合學習	Q4. 跟傳統上課方式比較，你覺得使用翻轉式混合學習模式上課是否更有效率？為什麼？
	Q5. 跟傳統上課方式比較，你覺得使用翻轉式混合學習模式上課的優缺點是什麼？
整體感想	Q6. 跟傳統上課方式比較，你覺得使用ePUB3電子書以及翻轉式混合學習模式上課是否更有效率？為什麼？
	Q7. 跟傳統上課方式比較，你是否更有意願使用ePUB3電子書以及翻轉式混合學習模式上課？為什麼？
	Q8. 跟傳統上課方式比較，你覺得使用ePUB3電子書以及翻轉式混合學習模式上課的優缺點是什麼？

1. 確認寫作學習目標

如同一般課程，在設計課程活動及製作教材之前，應先確認授課對象以及學習目標，並需先了解授課對象的先備知識、學習特質等，如此方能針對學習對象量身打造適合的學習活動及教材內容。以本研究所探討的「摘要寫作」單元教學與評量而言，其授課對象為某大學大一學生，未接受過專業寫作訓練也未具備先備知識，因此設定以下三項「摘要寫作」學習目標：⑴找出文章主旨，摘錄重點語句與段落大意；⑵對文章做整理與重組，以簡潔扼要語句重新表達；⑶具備有效閱讀、再次閱讀的能力。

2. 規劃寫作學習活動

此部分為寫作課程設計的核心，可透過以下幾項工作完成規劃：

⑴根據翻轉式混合學習模式，決定寫作課程的各個學習活動。一般而言，翻轉式混合學習寫作課程是以學生為核心，提升其自主學習寫作的能力，因此學習活動皆以學生為主體、包括有：i.上課前學生預讀寫作教材內容；ii.上課時先進行課前測驗（前測）以了解學生預讀成效；iii.上課期間學生透過寫作題目討論以深化寫作思考與訓練，或由老師（根據前測結果）針對寫作教材內容進行補充說明；iv.上課結束時進行課後測驗（後測）以驗證學生寫作學習成效。

⑵依據各個學習活動，決定其進行時所需具備的特性。一般而言，為達成翻轉式寫作學習而進行的學習活動可具備七個特性：i.學習理論，也就是學習活動所採用的學習理論，包括行為學習、認知學習、建構學習等；ii.學習方式，例如個別、分組、班級等；iii.學習型態，例如直接教導、學生討論、專題製作、問題解決等；iv.學習模式，例如面對面講授、線上操作ePUB3電子書、混合（面對面及線上操作）模式等；v.學習地點，例如一般教室、電腦教室、學校外等；vi.學習時間，也就是學習活動所需花費時間；vii.學習資源，也就是學習活動可獲得的資源，例如特殊設備、教學助理等。

⑶依據各個學習活動所需具備的特性，將學習活動依其進行的順序關係規劃完成。以本研究所探討的「摘要寫作」單元課程而言，其學習活動可規劃如下：

i.上課前，學生先預讀「摘要寫作」教材（A.1）：此教材內容著重於「摘要寫作的原則、步驟，以及實例」，而預讀教材則為學習理論的行為及認知學習的運用，以累積摘要寫作的知識。因此，特性上可規劃為：運用行為及認知學習理論，於學校外透過線上操作ePUB3電子書、以個別方式進行、直接閱讀教材、七天時間預讀。

ii.上課時，學生先進行課前測驗（前測）（A.2）：以了解其對於摘要寫作的理解狀況，此為認知學習的運用。因此，特性上可規劃為：運用認知學習理論、於電腦教室、透過線上操作ePUB3電子書，以個別方式進行、直接回答題目、10分鐘時間測驗、教學助理監督。

iii.正式課堂上課時，使用「摘要寫作」教材（A.3）：學生自行閱讀電子書，並由老師根據前測結果進行補充說明，以增進摘要寫作的理解，此為行為及認知學習的運用。因此，特性上可規劃為：運用行為及認知學習理論、於電腦教室、透過混合（面對面講授及線上操作ePUB3電子書）模式、以班級方式進行、老師補充說明、15分鐘時間進行、教學助理協助。

iv.正式課堂上課時，使用「分組討論」教材（A.4）：學生自行操作電子書，並根據老師指定分組及練習題目進行討論，使學生能透過同儕間互動及討論構築新的體會，增強摘要寫作的理解及應用能力，此為認知及建構學習的運用。因此，特性上可規劃為：運用認知及建構學習理論、於電腦教室、透過線上操作ePUB3電子書、以分組方式進行、學生討論題目答案及口頭發表成果、45分鐘時間進行、老師及教學助理協助。

v.上課結束時，學生進行課後測驗（後測）（A.5）：學生須回答問題並撰寫一份摘要報告（以文書編輯器繕打完成後，於系統中上傳），使學生能透過答題過程的思考，建立其摘要寫作知識脈絡，以驗證其對於摘要寫作理解及應用的學習成效，此為認知及建構學習的運用。因此，特性上可規劃為：運用認知及建構學習理論、於電腦教室、透過線上操作ePUB3電子書、以個別方式進行、直接回答題目、25分鐘時間測驗、教學助理監督。

3. 設計電子書寫作教材內容

此步驟以配合寫作學習活動的進行為核心，以完成寫作課程的ePUB3電子書教材內容設計，使教材內容能配合學習活動的進行，透過ePUB3電子書的豐富樣式傳遞給學生，以增加其學習興趣，強化其對課程內容的了解，進而提升其學習成效。

以上述「摘要寫作」單元課程的學習活動而言，此ePUB3電子書教材內容可於設計之初，根據學習目標將所要傳遞的摘要寫作基本概念與應用知識，以

有系統的方式加入教材，並配合學生預讀教材（A.1）以及老師補充說明（A.3）等學習活動的進行，將教材內容適當的組織化，以累積、增厚摘要寫作的知識。為了配合課前測驗（A.2）的進行，測驗內容可「透過答題過程的思考，使學生理解摘要寫作的原則、步驟，以及實例」做為設計的原則。此外，為了配合學生進行分組討論及口頭發表成果的學習活動（A.4），在教材中也可另外加入練習題目及思考綱要，以引導學生進行討論，使摘要寫作的知識能透過「已知」加「未知」而構成新的體會，並進而獲得學習的增強。最後，為了配合課後測驗（A.5）的進行，測驗內容可「透過答題過程的思考，使學生建立自己的摘要寫作知識脈絡，並進而得到反思與內化」做為設計的原則。

在完成上述ePUB3電子書寫作教材內容設計後，即可著手進行此電子書的功能設計。由於ePUB3具有豐富的功能性格式規範，例如多樣化版面、多媒體嵌入、互動性功能，以及動態式呈現等，因此如何於電子書嵌入這些功能、以實作出配合學習活動進行與落實教材內容傳遞的功能，就成為此工作的重點。具體而言，ePUB3所能提供的、可被嵌入於此電子書的功能（Lin et al., 2017），除一般性文字與圖片外，還包括：影片、參考連結、語音導讀、自動輪播、作業練習、分組討論以及考試測驗等。因此，以摘要寫作課程而言，其ePUB3電子書教材的設計，即運用了這些多樣化的ePUB3功能，以增加學生的閱讀興趣，並進而提升其學習成效。

4. 製作電子書寫作教材

在完成ePUB3電子書寫作教材內容以及ePUB3功能運用的設計後，接著即可著手進行此電子書的製作工作。有關ePUB3電子書的製作，目前已有許多開發工具可使用，例如ViewPorter[11]、InDesign[12]、Sigil[13]、Calibre[14]等，其中以Viewporter最為通行，製作出的電子書品質也相當受好評。以摘要寫作課程而言，其製作完成的「摘要寫作」ePUB3電子書教材部分頁面，如圖2（摘要寫作步驟的語音導讀，以及課間練習的進行）所示，而課程中將於分組討論活動（A.4）使用到的「分組討論」ePUB3電子書教材，則如圖3（分組討論的進行說明，以及答案的上傳繳交與口頭報告規定）所示。

5. 寫作課程授課與評量

在完成ePUB3電子書寫作教材製作後，接著便可排定日期進行寫作課程各個單元的實際授課，而此步驟的進行將依據前述規劃好的學習活動（如前述的學習活動A.1至A.5），透過ePUB3電子書寫作教材的使用，依其順序與時間，逐次完成各活動的學習工作。至於課程評量部分，則包括：(1)準實驗研

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11 http://viewporter.com

12 https://helpx.adobe.com/tw/support/ indesign.html

13 https://github.com/Sigil-Ebook/Sigil

14 http://calibre-ebook.com/

5 - 1 摘 要 寫 作

摘要寫作的步驟

1. 重複閱讀：先將原文熟讀，先概覽、再審閱重點何在。
2. 標記重點：找出至少五個關鍵詞，劃記在原文上，根據關鍵詞的脈絡，用來提示原文的精華。
3. 原文改寫：根據劃出的關鍵詞，用同義詞重新組合，予以改寫。

摘要寫作的步驟

重複閱讀

課間練習

1. 下列哪一項不是寫摘要的目的？
   - A 為了作業美觀方便
   - B 節省再次閱讀的時間
   - C 幫助建立記憶和印象
   - D 能找出閱讀的重點

2. 如果要將某一個活動成果摘要寫出，不必多加著墨的是：
   - A 活動的日期和時間
   - B 活動舉辦地點
   - C 活動的宗旨
   - D 活動中發生的事件

3. 如果要把一篇1000字的課文作成約200字的摘要，應該採取的步驟是：
   - A 標記重點→重複閱讀→原文改寫
   - B 原文改寫→重複閱讀→標記重點

4

圖2 「摘要寫作」單元ePUB3電子書教材內容示例

摘要寫作－討論題

以下這一段短文，請分組進行討論，由各組推派一位同學線上送出答案，另推派一位組長口頭發表成果：
(訂定五個關鍵詞、濃縮爲100字摘要)

最近第一次讀了安徒生的短篇小說《影子》（直譯，The Shadow）。起因是丹麥語口譯赫爾姆覺得我一定會喜歡，因而推薦給我。在讀它之前，我沒想過安徒生會寫這樣的小說。看了《影子》日文版後，覺得它是一篇帶有強烈恐怖發展的故事。對大多數日本人而言，安徒生是童話故事的作者，得知他寫了這麼陰暗、了無希望的幻想故事，感到十分驚訝。於是興起了疑問，也就是「為了什麼一定要寫出這樣的小說？」小說的主人翁是一位離開北方故鄉，前往南方國家旅行的年輕學者。發生了令人意想不到的事，他的影子不見了。當然，他感到不知所措，於是想辦法弄了新的影子，平安回到故鄉。然而，之後，他失去的影子卻回到他身邊。在這段期間舊影子有了智慧和力量，獨立了，如今不論是從經濟上、社會上來，都比原來的主人更卓越。換言之，影子和主人的立場互換了。現在影子變成了主人，主人變成了影子。影子愛上了別國美麗的公主，並變成了那一國的國王。於是他把知道自己過去是影子的前主人給殺了。影子活了下來，寫下偉大的功績，而身為人類的他的前主人則悲哀地消失無蹤了。我並不知道安徒生在寫這篇小說時，設定哪些人為讀者。但是我從中得到的是，擅長寫童話的安徒生，捨棄了既有的寫作框架，也就是寫給小孩子

開啓word編輯答案，再以上傳檔案的方式送出繳交。

選擇檔案 檔案上傳



注意：
- 由各組推派一位同學線上送出答案，另推派一位組長口頭發表成果（訂定五個關鍵詞、濃縮為100字摘要）。
- 檔案可多次上傳，將以最後一次上傳的檔案為主。



圖3 分組討論活動ePUB3電子書教材內容示例



究法的實驗組及控制組對照分析，以驗證應用翻轉式混合學習模式與ePUB3電子書於寫作教學的學生學習成效，以及⑵問卷調查以了解學生對課程的滿意度。

四、翻轉式寫作課程教學與成果評量

在提出應用ePUB3電子書於翻轉式混合學習的寫作課程設計流程後，本研究即運用此流程於「摘要寫作」單元的實際教學與評量，並經由準實驗研究法的實驗組及控制組對照分析，以及學生滿意度調查及感想訪談，以驗證應用翻轉式混合學習模式與ePUB3電子書於寫作教學的學生學習成效及滿意度。本節先於第一部分討論摘要寫作課程設計及教材製作，而實務教學與評量將於第二部分進行介紹，最後於第三部分針對實務教學與評量結果進行討論。

㈠摘要寫作課程設計及教材製作

如表6有關實驗組學習活動（使用ePUB3電子書）所示，此摘要寫作課程的實驗組共設計有五個學習活動A.1至A.5，其中各個學習活動進行時所需具備的特性亦有完整規劃，例如「A.1預讀教材」為「行為及認知學習理論」的運用，學生於「學校外」、透過「個別方式」、經由「線上操作」ePUB3電子書、於「7天」內完成「教材閱讀」的學習活動。而在規劃完學習活動後，即可進行課程使

表6　摘要寫作課程設計（實驗組與控制組）

課程名稱	摘 要 寫 作						
學習目標	1.找出文章主旨，摘錄重點語句與段落大意 2.對文章做整理與重組，以簡潔扼要語句重新表達 3.培養有效的閱讀能力，節省再次閱讀所需時間						
翻轉式 混合學習模式	上課前	上課開始時		上 課 時		上課結束前	
	學生 預讀教材	學生進行測驗 （前測）		老師 補充說明	學生 分組討論	寫作練習 （後測）	
		教學助理監督		老師及教學助理協助		教學助理監督	
實驗組學習活動 （使用ePUB3電子書）	特 性						
	學習理論	學習方式	學習型態	學習模式	學習地點	學習時間	學習資源
A.1預讀教材	行為及認知	個別方式	教材閱讀	線上操作	校外	7天	
A.2課前測驗	認知	個別方式	題目回答	線上操作	電腦教室	10分鐘	教學助理
A.3補充說明	行為及認知	個別方式	教材閱讀 補充說明	線上操作 面對面	電腦教室	15分鐘	老師 教學助理
A.4分組討論	認知及建構	分組方式	題目練習	線上操作	電腦教室	45分鐘	
A.5課後測驗	認知及建構	個別方式	題目回答	線上操作	電腦教室	25分鐘	教學助理
控制組學習活動 （使用紙本及影片）	特 性						
	學習理論	學習方式	學習型態	學習模式	學習地點	學習時間	學習資源
A.1預讀教材	與實驗組相同			紙本翻閱 線上觀看	校外	與實驗組相同	
A.2課前測驗				紙本作答	一般教室		
A.3補充說明				面對面	一般教室		
A.4分組討論				面對面	一般教室		
A.5課後測驗				紙本作答	一般教室		

用的ePUB3電子書教材內容設計工作，其中包括為配合各個學習活動進行而需運用的ePUB3功能，例如為配合「預讀教材」的進行，此ePUB3電子書教材將使用圖片、影片、語音導讀、自動輪播等功能，以協助學生完成「教材閱讀」的學習活動。最後，在整合教材內容所運用的ePUB3功能後，即可設計出此摘要寫作課程的ePUB3電子書教材，並接續進行此電子書製作工作，如同流程第四步驟所述，此摘要寫作課程的ePUB3電子書製作，是以Viewporter做為開發工具，而製作出的電子書（如前述圖2及圖3所示）。

至於此課程的控制組，則因接受不採用ePUB3電子書的傳統翻轉式學習模式，因此如表6有關控制組學習活動（使用紙本及影片）所示，設計有與實驗組相同的五個學習活動A.1至A.5，但使用內容與實驗組完全相同的紙本及影片教材，例如「A.1預讀教材」的特性與實驗組相同，僅「線上操作」ePUB3電子書改為「翻閱」紙本教材及「觀看」線上影片。

㈡摘要寫作課程實務教學與評量

本研究依研究方法所述之研究對象為基礎，於106學年度第1學期的2017年12月15日上午進行採用ePUB3電子書的實驗組翻轉式混合學習實務教學，而於下午進行不採用ePUB3電子書的控制組翻轉式混合學習實務教學，而課程實施過程則依據表6所設計的各組A.1至A.5五個學習活動進行，圖4為此課程的教案及活動流程。

其中實驗組部分，其活動流程及內容如圖4所示，首先於前一週（12月8日）班級下課前，對學生介紹次週上課要進行的ePUB3電子書翻轉學習模式（即表6所示實驗組五個學習活動A.1至A.5）以及ePUB3電子書的使用方式，並說明次週（12月15日）上課前7天內，需完成ePUB3電子書教材預讀，並於當天上課時先進行課前測驗，以了解學生對於摘要寫作的理解狀況（例如，對於摘要寫作原則或步驟的理解狀況），並於上課時首先由老師根據前測結果進行補充說明（例如，針對學生理解較差部分進行補充說明），接著根據老師指定分組及練習題目進行討論，以增強學生的摘要寫作理解及應用能力，最後於上課結束時進行課後測驗，以驗證其對於摘要寫作理解及應用的學習成效。

至於控制組班級，其活動流程及內容也如圖4所示，於前一週（12月8日）下課前，對學生介紹次週上課要進行的（不採用ePUB3電子書）傳統翻轉學習模式（即表6所示，與實驗組相同的控制組五個學習活動A.1至A.5，但使用內容與實驗組完全相同的紙本及影片教材），並要求次週（12月15日）上課前7天內，需完成紙本及影片教材的預讀，12月15日上課時以紙本方式進行課前測驗及課後測驗，而老師補充說明及學生分組討論則以面對面方式進行。

1. 實驗組及控制組學習成效對照分析

在12月15日上／下午時間完成實驗組／控制組的實務教學後，透過25分

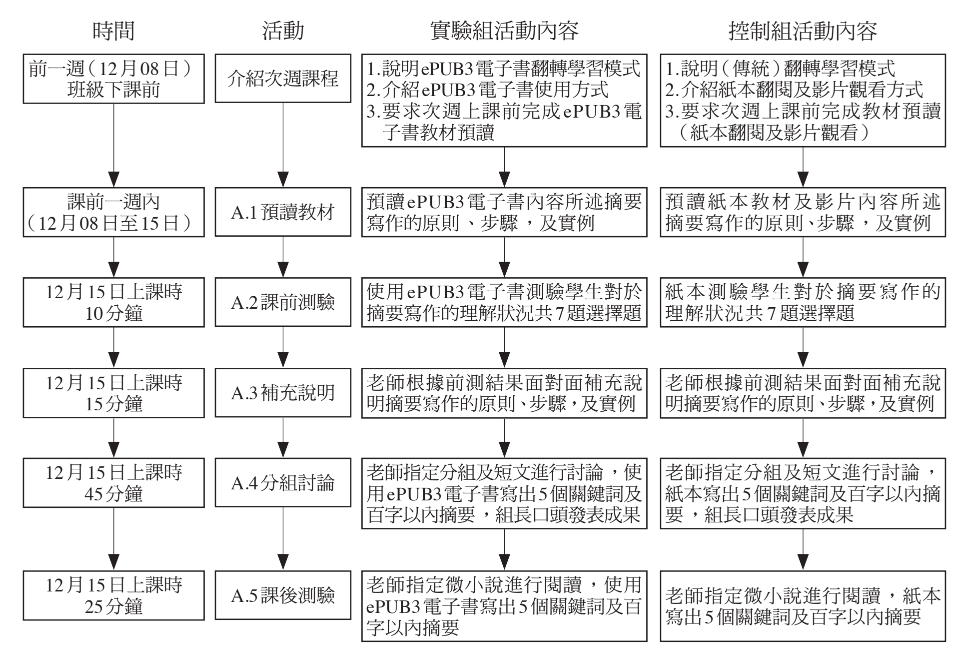


圖4　摘要寫作課程教案內容及活動流程（實驗組與控制組）

鐘的課後測驗（實驗組43人、控制組47人完成測驗），以驗證學生的學習成效。為驗證實驗組的學習成效是否優於控制組，本研究提出以下研究假設：「應用翻轉式混合學習模式與ePUB3電子書於摘要寫作的學習成效優於傳統翻轉教學方式的學習成效」。

由於本研究在教學設計上要求學生於課前預讀課程內容，且實驗組與對照組的預讀方式與教材不盡相同，因此，不同預讀方式與教材就有可能影響最終的學習成效。為排除不同課前預讀行為對於最終學習成效的影響，因此本研究採用單因子共變數分析（analysis of covariance）以排除前測成績對於後測成績的影響，其中共變數為前測成績，自變項為組別（實驗組、控制組），而應變項則為後測成績。

表7為組內迴歸係數同質性檢定摘要表，檢定結果顯示，在「內容掌握度」、「文句流暢度」、「關鍵詞選定」，與「整體試題」等四個項目的F值分別為2.057、0.279、0.109，與0.983，而p值則分別為 .155、.599、.742，與 .324，由於所有檢定項目的p值皆大於 .05，表示在這四個項目之實驗組與控制組的迴歸線斜率相同，符合共變數分析的組內迴歸係數同質性的前提假設，因此可進行共變數分析。

表8為共變數分析摘要表，在「內容掌握度」、「文句流暢度」、「關鍵詞選定」，與「整體試題」等四個項目的F值分別為0.128、7.995、7.414，與5.131，而p值則分別為 .722、.006、.008，與 .026；其中「文句流暢度」、「關鍵詞選

表7　實驗組與控制組摘要寫作學習成效後測之組內迴歸係數同質性檢定摘要表

評分項目	*Type III SS*	*df*	*MS*	*F*值	*p*
內容掌握度	40.674	1	40.674	2.057	.155
文句流暢度	2.558	1	2.558	0.279	.599
關鍵詞選定	1.521	1	1.521	0.109	.742
整體試題	79.213	1	79.213	0.983	.324

表8　實驗組與控制組摘要寫作學習成效後測之共變數分析摘要表

評分項目	組別	人數	調整後平均數	*F*值	*p*	η^2
內容掌握度	實驗組	43	29.954	0.128	.722	.001
	控制組	47	29.617			
文句流暢度	實驗組	43	28.674	7.995**	.006	.084
	控制組	47	26.873			
關鍵詞選定	實驗組	43	20.860	7.414**	.008	.079
	控制組	47	18.724			
整體試題	實驗組	43	79.441	5.131*	.026	.056
	控制組	47	75.150			

*p < .05; **p < .01.

定」，與「整體試題」的p值皆小於 .05，只有「內容掌握度」之檢定結果未達顯著。因此，「文句流暢度」、「關鍵詞選定」，與「整體試題」在排除前測成績的影響後，實驗處理效果顯著，實驗組的調整後平均分數分別為28.674、20.860，與79.441，而控制組的調整後平均分數則分別為26.873、18.724，與75.150，在顯著水準為 .05的情況下，這三個項目之實驗組的學習成效顯著優於控制組的學習成效。由於在「整體試題」的平均分數上，實驗組顯著優於控制組，故而支持了本研究假設，也就是應用翻轉式混合學習模式與ePUB3電子書於摘要寫作的學習是相當有成效的。

2. 問卷調查了解學生對課程的滿意度

最後，有關學生對於使用ePUB3電子書教材進行摘要寫作學習成效的自我評量，本研究於實驗組上課結束後，使用表4的9個問卷題目Q1至Q9進行調查，而學生對此九個題目的回應結果顯示平均分數分別為5.71、5.68、5.76、5.66、5.54、5.32、5.62、5.67，與5.59，皆達到7個等級的「良好」（5分）等級（僅次於6分的最高等級）以上，可見學生普遍對於使用翻轉式混合學習模式與ePUB3電子書進行摘要寫作學習是滿意的，未來也會優先選擇採用翻轉式混合學習與ePUB3電子書上課的課程。

此外，從題目Q1至Q4有關使用ePUB3電子書上課的高滿意度回應可知，學生對於ePUB3電子書使用動畫重複播放、影片播放搭配小測驗等多媒體及互動功能以提升學習效率是相當滿意的。然而，由題目Q5及Q6有關使用翻轉式混合學習上課的較低滿意度亦可知，有較多學生對於使用翻轉式混合學習是

感到不滿意的，特別是題目Q6：「跟傳統的上課方式比較，使用翻轉式混合學習模式上課，是否讓你覺得更以你為核心、提供你更能自己掌控學習的學習環境？」的評量平均分數是9個題目中最低的。為此，本研究經過了解後得知，主要是因部分學生覺得課程學習活動的規劃仍過於制式，特別是上課時的老師補充說明以及學生分組討論，如何搭配ePUB3電子書的閱讀，應該保有彈性運用的空間。針對此點，本研究亦認為值得於未來工作加以詳細探討，以期能透過更加完善的自主性及合作性學習模式，提升學生對於翻轉式混合學習的興趣及參與意願。

3. 面對面訪談了解學生對課程的感想

最後，本研究也於實驗組上課結束後，以面對面方式，進行學生對於使用ePUB3電子書教材進行摘要寫作學習的感想訪談。而訪談結果也顯示，8位學生有7位（除編號#6者外）對於此摘要寫作單元的學習，不論ePUB3電子書、翻轉式混合學習，或整體感想，都表示正面的滿意態度，以下列舉部分回應：

(1) 使用ePUB3電子書

> 利用電子書的方式上課，對我來說方便很多，不懂的地方可以重複去看，很不錯！（編號#3）
>
> 我覺得電子書會提升樂趣，使大家樂於學習，也會因為閱讀方式的不同，可以將內容快速記在頭腦，比紙本更容易學習。（編號#5）
>
> 我覺得電子書很方便，上課可以更專注，不會聽到一半就分心，自己實際操作也更有感觸。（編號#7）

(2) 使用翻轉式混合學習模式

> 我蠻喜歡上課前能夠預讀，這樣上課時就不會那麼茫然，也可以有充足的時間寫筆記和查詢資料跟吸收思考。（編號#3）
>
> 我覺得上課時可以自己操作電子書很方便，而分組討論也可以讓我知道同學的看法，蠻好的一種新學習方式。（編號#5）

(3) 整體感想

> 我覺得使用翻轉方式上課十分新鮮，電子書教材也很有趣，跳脫以往的紙本，對學習很有幫助的。（編號#3）
>
> 我喜歡這樣的翻轉方式上課，可以自己決定看電子書的內容，後面的分組討論可以讓我跟其他同學一起討論老師給的題目，讓我很有參與感，很棒！（編號#5）
>
> 同時使用電子書跟翻轉方式上課，等於一次體驗兩種新的學習方式，又能在遇到問題時，馬上得到老師或助教的幫忙，希望以後能更多這樣的上課方式。（編號#7）

然而，也有1位學生（編號#6）有不同看法，以下為其表示的意見：

⑴使用ePUB3電子書

雖然電子書很方便，但覺得它在某些地方還是不太方便，像是想要跳到某頁去就只能先到目錄去點選，然後從章節開始地方去翻頁，感覺還是不太方便。（編號#6）

⑵使用翻轉式混合學習模式

我覺得翻轉式混合學習用意很好，但上課時的進行順序還是不夠好，像是老師先補充說明之後再開始分組討論，但同組裡面有同學都不進來留言，因為他們還是不清楚老師補充說明的地方，所以不知道要怎麼討論，這樣效果就不好，應該要想辦法讓他們先瞭解老師的補充說明，再讓他們進來組裡面討論才對。（編號#6）

⑶整體感想

我覺得同時使用電子書跟翻轉方式上課還是好有挑戰性，像在分組討論時想要查資料去看電子書，就覺得要花蠻多時間來翻頁到想查的資料，如果能在討論區裡面直接連結到這些資料就更好了。（編號#6）

最後，根據以上訪談活動所獲得的質性資料，我們進一步使用模板式分析法（Template Analysis Style）將訪談記錄轉換成抽象概念並建立本研究的代碼系統（Crabtree & Miller, 1999）。首先，根據本研究的目的而預建「ePUB3電子書翻轉式混合學習（A）」這一項主旨代碼以及「翻轉式混合學習（B）」與「ePUB3電子書（C）」這兩項子代碼的層級結構，並在此層級結構之下，從訪談紀錄擷取出：「自主操作（B1-1）」、「重複閱讀（B1-2）」、「預讀（B1-3）」、「分組討論（B2-1）」、「同儕學習（B2-2）」、「參與感（B2-3）」、「新鮮感（C1-1）」、「有趣性（C1-2）」、「易用（C2-1）」、「方便（C2-2）」、「好用（C2-3）」、「自在（C2-4）」、「網路速度（C2-5）」、「影片流暢度（C2-6）」、「使用習慣（C3-1）」、「使用意願（C3-2）」、「提升學習效率（C4-1）」、「幫助理解（C4-2）」、「增加思考時間（C4-3）」、「幫助記憶（C4-4）」、「提升專注程度（C4-5）」與「降低學習難度（C4-6）」等22項代碼。接著，再針對這22項代碼進行分類，而得到「自主學習（B1）」、「合作學習（B2）」、「吸引力（C1）」、「易用性（C2）」、「接受度（C3）」、「有用性（C4）」等六個分類項目。最後，將主代碼與子代碼合併，形成如圖5的代碼系統。根據此代碼系統，我們認為受訪學生在翻轉式混合學習方面所關注的議題主要為自主學習與合作學習，而在ePUB3電子書方面，受訪學生關注的議題主要為電子書的吸引力、易用性、接受度，以及有用性等四個分類項目。

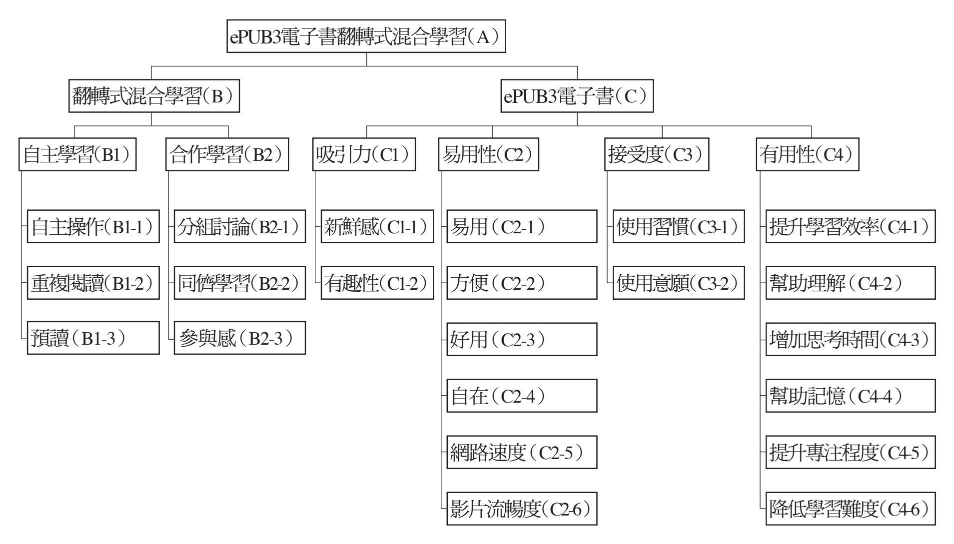


圖5　本研究之代碼系統

㈢結果及討論

由上述的實際教學與評量結果可知，本研究所設計的翻轉式混合學習寫作課程設計流程，以及使用的ePUB3電子書寫作教材，經由實際運用於摘要寫作課程的教學與評量，對於提升學生的摘要寫作學習確有一定的成效，且學生亦普遍能接受使用翻轉式混合學習模式以及ePUB3電子書教材進行學習，尤其對於透過電子書自行閱讀或討論，更持相當正面的態度，因此也驗證了本研究所設定的兩個研究問題。

然而，透過實際教學經驗及評量結果的回饋，本研究亦對於應用翻轉式混合學習模式與ePUB3電子書於寫作教學，提出以下討論及建議：

1.同時應用翻轉式混合學習模式與ePUB3電子書於寫作教學，課前準備事關重要，特別是學習活動的規劃及ePUB3電子書教材內容的設計與製作；其中學習活動需以學生為主體，透過自行閱讀及討論等方式，提升其自主學習寫作的能力，而教材設計則需以配合學習活動的進行為依據，使教材內容能於學習活動中，適時的透過ePUB3電子書的豐富功能傳遞給學生。目前教育界更已有許多使用翻轉學習做為寫作課程教學方法的經驗，其教學過程也使用許多數位學習工具、例如學習平台、行動裝置等，但仍存在許多使用課本或影片等傳統寫作教材所產生的限制，因此善用ePUB3電子書的功能，使學習活動能透過學生自主閱讀及合作討論等方式進行，將可提升學生的摘要寫作學習成效。

2.實際課程進行過程中，由於是學生同時自行閱讀教材及參與翻轉式學習活動，老師將會需要隨時處理不同學生的不同問題，例如電子書無法操作或操

作不順利、分組學生不參與討論等，因此須隨時關注學生學習狀況、發現問題了解原因，並給予適時的協助或輔導，就顯得更為重要。雖然目前教育界在使用翻轉學習做為寫作課程教學時，無不強調關心及輔導學生參與學習活動情形的重要，但由於使用課本或影片等傳統寫作教材所產生的限制，使得學生不容易於學習活動進行時依本身狀況彈性學習教材內容，從而降低其參與學習活動的意願，如此也就容易增加老師關注學生學習狀況、發現問題並給予協助或輔導的壓力。因此善用ePUB3電子書的功能以增加學生依本身狀況彈性學習的空間，從而提高其參與學習活動的意願，將可減低老師教學時協助或輔導學生參與學習活動的壓力。

3.根據問卷調查及面對面訪談的學生反映，除了能了解學生對於課程進行的滿意度及感想，更重要的是能從學生角度去發現可能的缺失，例如部分學生覺得學習活動的順序過於制式，特別是老師補充說明及學生分組討論的進行，如何搭配ePUB3電子書的閱讀，應保有彈性運用的空間；此外，也有部分學生覺得同時使用電子書跟翻轉方式上課太有挑戰性，應再加強電子書的操作方便性。因此，本研究認為，透過問卷調查及面對面訪談的學生反映，以了解學生的學習感受以及遭遇的問題，更是同時應用翻轉式混合學習模式與ePUB3電子書於寫作教學所應重視的課題。

此外，透過實際教學的觀察及輔導，本研究亦對於教學活動的進行歷程，尤其預讀教材及分組討論的進行，有以下的心得及省思：

1.課前預讀教材為翻轉式混合學習模式的必要活動，目的在使學生能於課前了解摘要寫作的原則、步驟，以及實例，而增加上課時參與分組討論的能力。但由於目前對於學生預讀ePUB3電子書教材情形，尚未做到詳細的追蹤，以至於僅能根據前測結果以了解學生的預讀成效，對於預讀情形不佳者則無法於預讀期間做適時輔導，以改善其預讀情形、增加對於摘要寫作的理解。然而，由於ePUB3電子書已可支援閱讀追蹤的功能，因此如何運用此功能以強化對於學生預讀情形的了解與掌握，可做為未來持續增進教學成效的一項研究課題。

2.課程進行時，分組討論為核心活動，目的在使學生能透過同儕間互動及討論構築新的體會、增強其摘要寫作的理解及應用能力。然而，目前的小組討論方式尚屬一般形式討論，並未實施特定的深化討論模式，因此誘發及參與討論的機制並不完整，以至於會發生討論過程無法持續或結論無法聚焦等現象，從而降低討論的成效。因此如何透過適當的深化模式，經由完整的誘發及參與討論機制，以增進學生的討論意願與成效，也可成為未來的另一項研究課題。

五、結論與建議

㈠研究成果及貢獻

近年來，隨著網路技術與雲端應用的快速進步與發展，如何運用愈來愈成熟的線上學習技術與環境以擴展教育範圍、增加學習機會、強化知識獲取，已成為各級學校、機關團體、企業單位等，增進其成員素質、維持其競爭優勢的最主要憑藉之一。國內目前有關這方面的研究也已有一定成果，但與西方先進國家相較，仍有許多待發展或改善的地方。

本研究著重於如何應用新興的ePUB3電子書技術於大學通識課程的寫作教學，並針對電子書教學的教案規劃與教材製作提出以翻轉式混合學習為基礎的寫作課程設計流程，並以此流程所規劃的教案內容以及製作的ePUB3電子書教材，實際以翻轉式混合學習的模式運用於某大學通識課程「摘要寫作」單元的教學與評量。而經由課後準實驗研究法的實驗組及控制組對照分析，以及問卷調查與面對面訪談的結果可知，本研究所設計的翻轉式混合學習課程與使用的ePUB3電子書教材，經由實際運用於摘要寫作課程的教學與評量，對於提升學生摘要寫作學習具有一定成效，且學生亦普遍能接受使用翻轉式混合學習模式及ePUB3電子書教材進行學習，尤其對於透過電子書自行閱讀或討論更持相當正面態度。此外，透過本研究的質性資料分析結果顯示（如圖4所示），受訪學生在翻轉式混合學習過程所重視的是自主學習與合作學習，至於在ePUB3電子書部分，則重視電子書的吸引力、易用性、接受度，及有用性等四個項目。此分析結果將可作為未來教師設計翻轉式混合學習課程以及ePUB3電子書教材的參考依據。

此外，值得探討的是，雖目前已有許多關於翻轉式混合學習的課程設計方案，如Chen與Chen（2014）提出的HFC翻轉教室，將教材閱讀與學習活動予以整合，提供學生方便的學習環境，而Ram與Sinha（2017）則提出一個適合翻轉式混合學習的FCM架構，並透過與學習管理系統（learning management system，簡稱LMS；如Moodle）的整合，提供學生整體的學習環境。此外，Wen等（2016）強調運用社群建構理論（Social Constructivism Theory）於翻轉學習活動的進行，並藉由能力本位學習（competency-based learning）及探究式學習（inquiry-based learning）等教學方法，強化學生的學習成效。但這些方案多以影片做為教材，較缺乏與學生的互動，不僅使學生較無閱讀參與感，也使學生受限於資訊單向傳遞而無法透過互動動態取得資訊。而本研究運用ePUB3電子書的豐富功能已改善此項的限制，不僅提供學生更便利的教材閱讀與資訊查詢環境，更為教師提供多元化且有效率的教學與輔助環境。

因此，本研究所提出以翻轉式混合學習為基礎的課程設計流程、教案內容、ePUB3電子書教材，以及運用ePUB3電子書於課程實務教學等內涵，可提

供數位科技輔助教學的先進及同好參考，並期許未來如此豐富而多元的數位輔助教學方式能對線上學習領域產生更多正面的成效與影響力。

㈡ 研究限制及未來研究建議

本研究的限制為，僅實際應用所提出的ePUB3電子書翻轉式寫作課程設計流程於某大學通識課程的摘要寫作單元教學與評量，對於學生學習成效及滿意度的驗證仍有可加強之處。因此，未來可持續應用於其他學校或單位的摘要寫作課程，以強化本研究的學生學習成效及滿意度驗證。此外，對於應用於寫作課程的其他單元亦有探討的價值。一般大學應用中文寫作課程，除摘要外，亦可包含許多其他寫作相關單元，例如筆記、書信、公文、劇本、報導，及新聞等，由於各個單元性質不同，教材與教法亦可能會有所調整，因此如何應用本研究所提出的課程設計流程於這些單元，並經由結果分析以評量成效，可成為未來驗證其實用性的研究重點。

此外，未來運用ePUB3電子書翻轉式混合學習模式時，可於課前預讀時搭配ePUB3電子書支援的閱讀追蹤功能，以強化對於學生預讀情形的了解與掌握，而於課程進行分組討論時，搭配適當的深化討論模式（例如腦力激盪法、深度討論法等），以增進學生的討論意願與成效。最後，亦可於學習活動搭配使用不同的教學方法，例如問題導向學習（problem-based learning）或情境學習（situated learning）等，以活化學習活動的進行，增進學生的學習成效。而翻轉式混合學習模式使用這些追蹤功能、討論模式，以及教學方法時，如何規劃學習活動以及設計與製作配合這些學習活動進行的ePUB3電子書教材，使教材內容能於學習活動中適時傳遞給學生，就顯得相當重要，因此未來也可朝此方向做深入探討。

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Research Article

An Application of ePUB3 eBooks to the Design and Teaching of Flipped 'Applied Writing' Courses: An Example of 'Abstract Writing'

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Abstract

In this paper, we explore the application of a newly introduced ePUB3 eBook technique on the flipped learning of writing courses and hence present a flipped lesson design process that specifies the lesson plan and curricular contents with ePUB3 functions used in learning activities for delivering desired contents. For illustration, the process is practically applied on the "Abstract Writing" unit of a Chinese "Application Writing" course in a local university. For assessment, a quasi-experimental study on the control analysis of experimental and control groups and its accompanied questionnaires and interviews is conduced to verify the effectiveness and students' favors of applying flipped learning and ePUB3 eBooks on the academic Chinese "Application Writing" courses. The research results show that the proposed design process for writing courses, through the application of flipped learning and ePUB3 eBooks, can improve the effectiveness of students' learning in abstract writing. Further, students also advocate using this approach in their learning.

Keywords: *Writing teaching, Flipped learning, Lesson design, ePUB3 eBook, Quasi-experimental study, Teaching assessment*

SUMMARY

In recent years, research about the management and related information systems of e-Learning have been widely conducted. Colleges started to deploy e-Learning platforms such as Moodle and iLearn to enable students to study course contents on these platforms for their learning. In addition, various auxiliary e-Learning channels such as MOOC have also become popular and they have extended the ways and methods of learning. From a learning perspective, this means that the curricular contents are delivered to students in an appropriate manner based on the sequence of learning activities in order to achieve the expected learning outcomes.

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Further, to respond to the developing trend of education, colleges have started to adjust teaching methods into a blended manner. The focus of such a blended learning is to impose e-Learning on their education systems. That is, utilizing both of the Internet technologies and the face-to-face interactions with teachers and students to improve the effects of teaching and learning. As one may recognize, such an achievement is due to the increased participation of students in a classroom that improves their learning experience. At present, among the possible modes of blended learning, flipped learning is one of the most commonly used approach that emphasizes a student-centered learning environment. It enhances students' interest in learning and also improves their abilities on independent learning through studying of curricular content and participating in class activities.

In this paper, we explore the application of a newly introduced ePUB3 eBook technique on the flipped learning of Chinese 'Applied Writing' courses. As such, teachers can take the advantages of ePUB3 eBooks to deliver the curricular contents in a variety of ways to students through appropriate flipped learning activities. Also, since our study focuses on the use of ePUB3 eBooks in the flipped learning, the discussion addresses the following three points: (a) the learning activities in the ePUB3 eBook-based flipped learning of Chinese 'Applied Writing' courses, (b) the design and construction of the content of the ePUB3 eBooks used in the flipped learning of Chinese 'Applied Writing' courses, and (c) the ways that ePUB3 functions are embedded into the ePUB3 eBooks for assisting the delivery of curricular contents and the completion of flipped learning activities.

Therefore, to achieve the purpose of our study, we explore and present a flipped lesson design process that specifies a lesson plan and curricular contents with ePUB3 functions used in learning activities for delivering desired contents. Based on the research of existing flipped learning approaches, we follow a process that takes many considerations at the flipped learning of Chinese 'Applied Writing' courses including the curricular contents of ePUB3 eBooks and the functions embedded in ePUB3 eBooks. The process includes the following five steps:

1. Identify each unit's objectives of a Chinese 'Applied Writing' course

This step focuses on the identification of each unit's objectives of an academic Chinese 'Applied Writing' course. For instance, the 'Abstract Writing' course unit discussed in our study has the following objectives: (a) to find out the main subjects of an article, excerpt its key sentences and paragraphs, (b) to reorganize an article to express its contents with concise sentences, and (c) to have the abilities of reading an article in an efficient manner.

2. Specify each unit’s learning activities of the Chinese ‘Applied Writing’ course

This step focuses on the specification of each unit’s learning activities of the writing course. For instance, the learning activities of the ‘Abstract Writing’ unit discussed in our study are: (a) before a class, students preview the curricular contents of the ePUB3 eBooks used in the class, (b) at the beginning of the class, students take a pre-class test for capturing the effects of their preview, (c) in the class, teachers deliver a supplemental lecture based on the results of pre-class tests to enhance the essential knowledge about writing and to assist students participate in later group discussions, (d) in the class, with sufficient essential knowledge about writing, students participate in the group discussions on writing topics to deepen their writing thinking and training, and (e) at the end of the class, students take a post-class test for evaluating their learning in the class.

3. Design the contents of the ePUB3 eBooks used in each unit of the writing course

This step focuses on the content design of the ePUB3 eBooks used in each unit of the writing course. This is achieved by considering what the curricular contents are and how they are designed to take advantage of ePUB3 eBooks to be delivered to students in a variety of ways with the flipped learning activities in the unit. For the ‘Abstract Writing’ unit, the contents of its ePUB3 eBooks can be designed in a systematic way. Initially, considering the objectives of abstract writing, the basic concepts and application knowledge of writing an abstract can be added into the contents. Then, for the students pre-class preview, these contents can be organized in a layered manner for assisting their preview to gradually deepen their knowledge about abstract writing. In addition, for students’ group discussions on writing topics, an outline of thinking and sharing can be added to guide their discussions for constructing their own knowledge about abstract writing.

After designing the contents of the ePUB3 eBooks, it is then required to embed adequate ePUB3 functions in these eBooks. As the ePUB3 technology supports plenty of rich functions embedded in its compliant eBooks such as various templets, multiple media, interactive communications, and dynamic displays, the focus is therefore on how to employ the suitable functions into ePUB3 eBooks for assisting the delivery of designed contents under the flipped learning activities. In general, the most common functions used in ePUB3 eBooks can be picture, video, referential link, guided reading, automatic repetition, individual exercise, group discussion, and quiz and test.

4. Construct the ePUB3 eBooks used in each unit of the writing course

With the design of the contents and embedded functions of the ePUB3

eBooks, this step focuses on the construction of these eBooks. In general, this can be achieved by adding the designed contents and embedded functions into eBooks using applicable tools such as ViewPorter, InDesign, Sigil, and Calibre. Based on their features and the quality of constructed artifacts, ViewPorter is adopted herein to construct the ePUB3 eBooks.

5. Instruct and assess each unit's class of the writing course

After constructing the ePUB3 eBooks, the writing course can be instructed in accordance with the scheduled classes of its units. In this step, each unit's class is instructed under the above specified learning activities with the respective ePUB3 eBooks used for students' preview, pre-class test, in-class lecture, group discussion, and post-class test. For the assessment of the instructed class, two ways are conducted:

(1) A quasi-experimental study on the control analysis of experimental and control groups is conducted to verify students' learning effectiveness of applying our ePUB3 eBook- based flipped learning approach on the teaching of the class.

(2) A questionnaire and interviews are conducted to verify students' preferences about applying our ePUB3 eBook-based flipped learning approach.

The process above was practically applied in the Fall semester of 2017 on the 'Abstract Writing' unit of a Chinese 'Applied Writing' course at a local university. For assessment, a quasi-experimental study on the control analysis of experimental and control groups was conducted where (a) these two groups had 43 and 47 students respectively, (b) they had similar enrollment ages, scores, and backgrounds, and (c) they all had no learning experiences on flipped learning and ePUB3 eBooks. The results show that our proposed design process for writing courses, through the application of flipped learning and ePUB3 eBooks, can improve the effectiveness of students' learning in abstract writing. Further, after conducting the questionnaire and interviews, the results also show that students advocate using this approach in their learning.

Finally, it should be noted that although there are already many flipped learning approaches, they employ commonly videos as the learning media. Videos lack interactive and dynamic mechanisms, students get less involved in reading and hence have less interest in their learning. In contrast, our study uses ePUB3 eBooks as the learning media that employ the rich functions of the ePUB3 technology to alleviate such restrictions. It not only provides students with a more attractive learning and communicative environment, but also provides teachers with an efficient teaching and supportive environment.

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Research Article

Quality Discussion and High-Level Comprehension: An Analysis of Taiwanese College Students

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Abstract

Reading has been a focus of research attention because it is one of the important skills to achieve academic success and become life-long readers. Most research in reading puts focus more on how readers can comprehend information from reading; however, only a few studies have focused on how reading can facilitate readers' critical thinking. One teaching approach, Quality Talk (QT), has been found to enhance students' literal comprehension and critical thinking, but these studies have been conducted in classes where English was students' first language. Therefore, the present study aimed to examine the effects of QT on Taiwanese students' reading comprehension in English and the development of critical thinking. Two classes were randomly assigned as a control and an experimental group respectively. While the students in the control group received regular English class, the students in the experimental group received a training session including how to ask questions and how to conduct group discussions. The students' reading comprehension was evaluated through multiple choices and open-ended questions; and their development of critical thinking was evaluated through group discussions which were recorded, transcribed, and analyzed. The results have shown that scores of the reading comprehension test in the experimental group were significantly higher, which suggested that the training session made the students more involved in the text and they thus had better understanding on the text. The experimental group students further used significantly more authentic questions, which suggested that the students were able to relate their personal experience and information of outside world to the text.

Keywords: *Text-based discussion, Discourse analysis, Group discussion, Reading comprehension, Critical thinking*

Introduction

Being able to comprehend and analyze the reading texts are critical requirements for students to achieve academic success and important skills for

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life-long readers (National Academy for Educational Research, 2015; National Assessment Governing Board, 2013). Because reading is a dynamic process that involves a range of complex cognitive and meaning making processes (e.g., Goffman, 1959; Nystrand, Wu, Gamoran, Zeiser, & Long, 2003), researchers have strived to construct what reading is and how reading relates to performance in order to plan on reading processes and to evaluate reading achievements. National Assessment Governing Board (2013) substantiate readers' cognitive abilities in reading from basic to advanced levels: to "locate and recall", "integrate and interpret", and finally "critique and evaluate". The advanced level of reading comprehension refers to the ability to "integrate, interpret, critique, and evaluate" in the present study.

In order to help students to achieve advanced level of reading performance, many teaching interventions in reading are proposed; group discussion is one of the effective approaches (Higham, Brindley, & Van De Pol, 2014; Nystrand et al., 2003). The following describes two theoretical frameworks that explain why learning is achieved in group discussion and why discussions can facilitate students' high-level comprehension. First, learning is taken place through participating in social activities (Rogoff, Matusov, & White, 1996; Vygotsky, 1962). The learning in group discussions can be realized through the "guided participation", which means that more competent individuals, students or teachers, provide assistance for less competent individuals to comprehend content knowledge and also learn to solve problems (Rogoff, 1990; Rogoff et al., 1996). Tharp and Gallimore (1988) provided a successful documentation of how guided participation can be achieved in Kamehameha Elementary Education Program (KEEP) project in which teachers gave guidance by asking authentic questions, modeling and giving feedbacks for low achievers during group discussions.

The other theoretical framework, Dialogism suggested by Mercer (1998, 2000, 2002) and Heath (1983), explains why dialogic discourses can benefit high-level comprehension. They propose that language is a tool for interlocutors to think collectively. When individuals engage in discussions, the context of the discussions become a "shared framework of understanding" (Mercer, 1998, p. 5). In order to achieve mutual understanding in the context, individuals/learners must understand interlocutors' meanings and then be able to respond by offering their own ideas, that is, using language as a vehicle to "co-reasoning". In this process of "co-reasoning", Mercer (1998) further suggests that the students can thus enhance cognitive ability and critical thinking skills. In contrast, monologic discourse involves exchange of the "truth" or "known" in which students have little chance to contributes their ideas or participate actively in the construction of knowledge (Bakhtin, 2010).

Based on the above studies, the group discussion seems to be a potential approach for learning. Therefore, recently there was an increased attention to the group discussions as teaching interventions on reading. Despite the fact that the group discussions seem to be theoretically effective, not all discussion approaches are equally effective in enhancing students' literal and high-level comprehension. This can be observed in Murphy, Wilkinson, Soter, Hennessey, and Alexander (2009). They conducted a meta-analysis aiming to examine the effects of text-based discussion approaches on both literal and high-level comprehension. In their review of 42 quality journal papers, most of the discussion approaches[1] were effective in enhancing students' literal comprehension; however, only a few studies focused on enhancing students' high-level comprehension, such as *Junior Great Books*, *Collaborative Reasoning*, and *Philosophy for Children* (adopted from Murphy et al., 2009).

In particular, *Book Club* was effective especially in enhancing students' metacognitive ability in a pre- and post-test experiment design. Murphy et al. (2009) concluded that while different discussion approaches were designed for different learning goals,[2] only a few text-based discussion studies aimed to enhance both literal and high-level comprehension. Therefore, Murphy and colleagues identified the benefits of the text-based discussion approaches and proposed Quality Talk (QT), which aimed to enhance both literal and high-level comprehension (Murphy, Firetto, Greene, & Butler, 2017). In particular, students' use of questions and feedback in group discussion was taken as discourse indicators of high-level comprehension because it was found that asking questions and having elaborated explanation (EE) and exploratory talk (ET) indicated students' critical thinking and reasoning in discussions (Soter, Wilkinson, Murphy, Rudge, Reninger, and Edwards, 2008). QT has been implemented in some studies and they were reviewed below.

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[1] The reviewed discussion approaches are *Instructional Conversations, Junior Great Books, Questioning the Author, Collaborative Reasoning, Paideia Seminars, Philosophy for Children, Book Club, Grand Conversations,* and *Literature Circles*.

[2] The goals of learning are divided into three types: Expressive, Efferent, and Critical analytical stance. The expressive stance indicates that students' discussions are more affective oriented. This approach requires more of participants' personal opinions, which includes *Book Club, Literature Circles,* and *Grand Conversations*. The efferent stance means the purpose of the discussion is to acquire information. This approach requires students to remember the factual information, which includes *Instructional Conversations, Junior Great Books,* and *Questioning the Author*. The critical analytical stance gives prominence to asking questions and understanding the underlying information of the text, which includes *Collaborative Reasoning, Paideia Seminar,* and *Philosophy for Children*.

Literature Review

The Discussion Approach: Quality Talk (QT)

Reninger (2007) examined the effect of Quality Talk (QT) on eight low-achievers' (four and fifth grade) reading and high-level comprehension. Because the researcher adopted a qualitative view, the data included the researcher's observation notes, transcriptions of student interviews, transcriptions of group discussions, and the students' writings. The students' reading comprehension was evaluated through their writing, while their high-level comprehension was evaluated through their group discussions. The data analysis revealed that the students' reading and high-level comprehension scores have improved. The students were able to give factual information extracted from the text in their writing and to use examples and reasons to support their claims (i.e., EE) in their discussions.

Davies and Meissel (2015) also adopted Quality Talk and investigated the effects of which on students' high-level comprehension in a New Zealand secondary school. In their study, they observed their students' performance in a control (i.e., regular group discussion) and an experimental (i.e., with Quality Talk) group on three time spots (before, during, and after intervention). All of the discussions were audio recorded. Through analyzing the students' group discussion recordings, the results have shown that the students of both groups interacted in a turn taking style at time one; however, when the students were more familiar with each other and the QT discussion approach, they were more engaged in the interaction at time three. In terms of students' quality of discussions, the students had more cumulative talk (CT, contributing one's ideas to a dialogue without challenging each other), and fewer ET at time three. Davies and Meissel (2015) explained that the students made gains in high-level comprehension, but not yet ready for challenges and disputes.

Li et al. (2016) compared the effects of three types of teaching interventions on fourth and fifth grade students' reading and high-level comprehension: TWA, QT, and Hybrid. TWA suggested a before, during, and after reading strategies teaching approach. Before reading strategies helped students foster their background information; during reading strategies helped students monitor their reading processes and made connections between texts and their background information; after reading strategies required students to identify a main idea of texts. QT intervention included teachers' teaching on how to ask questions and to make responses and teachers' scaffolding based on a set of pedagogical principles, such as promoting dialogic inquiries and productive discussions. Finally, the hybrid suggested a combination of both TWA and QT interventions. The students' reading comprehension and group discussion recordings were examined. It was

found that the students of the experimental groups (TWA, QT, and Hybrid) have improved their literacy understanding based on a multiple choice questions test; however, only the students in the QT group showed high-level comprehension by using significantly more authentic questions, EE, and ET. This suggested that the students have improved both literal and high-level comprehension through QT teaching intervention.

Discussion Approaches Used in Taiwan

Although QT has yet implemented in Taiwan, other text-based discussion approaches have been implemented. For example, Shen (2013) investigated three text-based discussion approaches (*Book Club,* BC; *Literature Circles,* LC; *Instructional Conversations,* IC) and compared their effects on students' literal and high-level comprehension. Four classes were assigned as basal, BC, LC, and IC group and were taught by four different instructors. All of the students underwent three major phases over a five weeks experiment: pre-test (comprehension tests and essays; in the first week), teaching interventions (not for basal group; for three weeks), and post-test (comprehension tests and essays; in the last week). There was no difference in the students' literal comprehension among four groups of students, but the students from BC, LC, and IC group outperformed the students in basal group in two tests (interpretive comprehension test and theme-related essays). Although these text-based discussion approaches did not aim for critical analytical stance (BC and LC for expressive stance; IC for efferent stance), text-based discussion approaches can benefit their students' high-level comprehension to some extent.

Based on the above discussion, it seemed that QT discussion approach was a helpful reading intervention to achieve literal and high-level comprehension, including the ability to critique and evaluate text content. However, the participants in the previous studies of QT were native English speakers. Therefore, the present study aimed to investigate its effect on Taiwanese college students. Two research questions were listed below.

1. Does QT group discussion approach influence college students' literal reading comprehension?

2. Does QT group discussion approach influence college students' high-level comprehension as evidenced by student-initiated discourse elements?

Method

Participants

Two classes were randomly assigned as a control and an experimental group, respectively. There were 38 students in the respective class, 20 female and 18 male students in the control group and 29 female and 9 male students

in the experimental group. They were eighteen and nineteen years old. All of the students were at higher intermediate English proficiency level based on a placement test administered by a national university located at northern part of Taiwan. Their proficiency was comparable to B2 level of Common European Framework of Reference for Languages (CEFR), which was a commonly used criterion for language proficiency worldwide. The students were non English major (mostly from college of humanities and education) and received two hours of freshman English course every week for 7 weeks in total in this study. The students have learned English for more than ten years and have experienced in group discussion activity in senior high schools.

Teaching Procedures

The students in both control and experimental group used the same designated textbook (*Q: Skills for* success *4*), but received different teaching interventions. The major differences were that the students in the experimental group received training on six types of questions in the first week as shown in Table 1: authentic, uptake, speculation, high-level thinking, affective, and connection questions (Murphy et al., 2017); definitions were shown in Table 2 (Full examples were presented in Appendix 1). In addition to the question lessons, the students were encouraged to give supports to their claims in their responses. Whenever the students made any claim about their feelings or thoughts, they were encouraged to give reasons, evidence or any kinds of supports to explicate their ideas.

Table 1 Teaching Schedule

Week	Control group	Experimental group
1	Grouping	Six question types introduction Grouping
2	Unit 1	Unit 1 (Question type practice: SQ and HLQ/Generalization)
3	Unit 1	Unit 1
4	Unit 2	Unit 2 (Question type practice: HLQ/Analysis and AfQ)
5	Unit 2	Unit 2
6	Unit 3	Unit 3 (Question type practice: Speculation and Connection question)
7	Unit 3	Unit 3

In the control group, the students had a traditional English reading class in which the instructor explained unfamiliar words and usages and interpreted English texts in Mandarin Chinese. After the explanation, the students conducted a group discussion in Chinese for about 20 minutes based on ten questions prepared by the instructor (Appendix 2). There were 10 groups in the control group (three to five students in a group). The students were then required to complete a comprehension test, which included five multiple-choice questions and

Table 2 Definitions for Six Question Types and Three Response Types

	Discourse element	Definition
1	Authentic Question (AQ)	AQs are open-ended and require thinking about, around, and with the text; there is no one "correct" answer.
1-1	Uptake Question (UQ)	UQs ask about something that someone else said previously. They must be content related and can be directed to a group or an individual.
1-2	Speculation Question (SQ)	SQs require students to consider alternative possibilities.
1-3	High-level thinking Question (HLQ) (Generalization and Analysis)	HLQs require students to build up ideas and generate new information by tying concepts and ideas together.
1-4	Affective Question (AfQ)	AfQs elicit connections between a student's life experience and the text.
1-5	Connection Question (CQ)	• CQs elicit connections to information that is commonly known in the discussion group. • CQs elicit connections between two or more textual materials.
2	Test Question (TQ)	TQs presuppose one or a set of "correct" answer(s); the answer(s) usually can be found in the textbook.
3	Responses	
3-1	Elaborated Explanations (EE)	EE consists of a statement of a claim and include at least two pieces of support (e.g., reasons or evidence).
3-2	Exploratory Talk (ET)	ET occurs when students share, evaluate, and build knowledge over at least three turns. Students reason collectively by challenging each other and responding to challenges with reasons and evidence.
3-3	Cumulative Talk (CT)	CT occurs when students build positively, but uncritically, on what others have said in episodes of at least three turns. Instances of cumulative talk do not include a challenge.

Source: Murphy et al. (2017, pp. 2-4).

three short answer questions (Appendix 3).

In the experimental group, the students also received vocabulary instruction on the meaning and word usages in Mandarin Chinese. After vocabulary introduction, the students in the experimental group read texts by themselves, and were required to underline important ideas and to write down comments or questions for about 30 minutes. After the reading, the students were required to propose two questions of one designated question type for practice. Two types of question were assigned for each unit. For example, they were required to propose two speculation and two connection questions in Week 6 on a group basis. There were 36 questions from 9 groups in the experimental group (four to five students in a group). These questions were submitted to the instructor in Week 6 and reviewed in the Week 7 in order to correct students' grammatical errors and confirm their understanding of question types. The assigned question types were presented in Table 1 above.

Before the group discussions, the students were required to recite 8 ground rules listed below (Davies & Meissel, 2015; Reninger, 2007; Reninger & Wilkinson, 2010; Soter, 2007).

1. Share our thoughts and listen to other's ideas
2. No need to raise hand to speak (One speaks at a time)
3. Interact with group members instead of your teacher
4. Respect others' points of view
5. If someone remains silent, ask him/her questions
6. It is OK to disagree with others' opinions
7. Raise new questions
8. Build connections between texts and self

They conducted the group discussions in Chinese based on the same ten questions and then completed the same comprehension test. Details of teaching procedures of each unit were shown in Table 3 below.

Table 3 Teaching Procedures in Unit 3

	Control group	Experimental group
Week 6	1. Warm-up (whole class discussion)	1. Warm-up (whole class discussion)
	2. Vocabulary introduction	2. Vocabulary introduction
	3. Guided reading (first half)	3. Silent reading
		4. Question types practice
Week 7	4. Guided reading (second half)	5. Review students' proposed questions
		6. Review ground rules
	5. Group discussion	7. QT group discussion
	6. Comprehension check	8. Comprehension check

Because the students needed time to practice and familiarize themselves with how to ask questions, how to give responses, and following the ground rules, only the group discussions in the third lesson (Unit 3) were analyzed and compared with the discussions recorded in the control group. Unit 3 described the lives author spent with her father and how she learned writing. The group discussions in the first and second lesson were treated as practice sessions.

Discourse Analysis

Data of the present study included two parts: the students' comprehension test scores and the students' group discussions. The students' literal comprehension was evaluated through a comprehension test, which included five multiple choice questions and three short answer questions. The former required the students to answer information about the text, such as "**what is the turning point of the author's life event?**", while the latter required the students to propose personal ideas and support one's idea based on the text, such as "**why**

does the author choose to have the same job as her father?” The analysis of the short answer questions was based on the following rubrics. When the students wrote a thesis statement and one kind of support (i.e., reason, evidence, example, or personal story), the student received two points (i.e., one point for thesis statement and one point for a piece of support). The students scored five points at most for each question. The research assistant graded the students’ short answer questions for the first time and the researcher reviewed the grading for the second time. Agreement reached more than 90%. Figure 1 was one example of marking. There were two pieces of supporting ideas (“S”) and one thesis statement (“T”), which were three points in total for this item.

2. You have read how the author’s father influence the author to become a writer. Have your parents influenced you similarly or differently? 3

In my family, my parents influence me by their attitude toward dealing with difficulties. (T) Speaking of my father, he is always patient and perseverance while facing problems. It triggers me that we shouldn't give up every chances which make us grow up. (S) Besides, when it comes to my mother, she taught me to cultivate positive thinkings. It truly helps me a lot when figuring out difficulties. (S) Above all, I'm trained to be a courageous and optimistic person because of my parents' well attitude toward things.

Figure 1 Sample of Short Answer Question Marking

For ease of scoring, the test was presented in terms of 100 points. For example, when a student got two multiple choice questions correct, then he got forty points out of 100; when a student got twelve points from the short answer questions section, then this student got 80 points out of 100 points. The comprehension test scores were the average scores of the two section.

The time of group discussions in Unit 3 were about 250 and 274 minutes in the control and experimental group, respectively. The average group discussion time was around 20 and 30 minutes for the control and experimental group, respectively. All of the students’ group discussions were transcribed by the research assistant and analyzed by the researcher/instructor. Five discourse

indicators suggesting high-level comprehension were identified in the students' group discussions: authentic questions (AQs), test questions (TQs), elaborated explanation (EE), exploratory talk (ET), and cumulative talk (CT; Soter, 2007). AQs were sub-divided into five secondary question types: uptake, speculation, high-level thinking, affective, and connection questions. In order to conduct a statistical analysis, the discourse indicators were accumulated and presented in how many times per minute. For example, there were twenty-two AQs in eighteen minutes group discussion, so there was about one AQ per minute.

Results

Normality tests were first used to examine the students' comprehension test scores and the distributions of five discourse indicators of both control and experimental group. Only EE and CT discourse indicators were normally distributed. Therefore, an independent sample *t*-test was adopted to compare the two discourse indicators between the control and experimental group, whilst a Mann-Whitney U test was adopted to compare the comprehension tests and the other discourse indicators (i.e., TQs, AQs, and ET) between the control and experimental group.

The independent *t*-test was adopted to examine EE and CT discourse indicators and there was no significant difference between the students of control and experimental group as Table 4 shows.

Table 4 Independent *t*-test for EE and CT

	Control group		Experimental group		*t*-test
	M	*SD*	*M*	*SD*	
EE	0.25	0.15	0.21	0.14	0.41
CT	0.19	0.07	0.17	0.09	0.35

The Mann-Whitney U test showed a significant difference between the control and experimental group as shown in Table 5 ($Z = -2.10$, $p = .01$).

Table 5 Mean Scores of the Comprehension Tests

	Control group		Experimental group		Z
	M	*SD*	*M*	*SD*	
Comprehension tests	70.88	16.00	78.53	10.24	–2.10*

$^{*}p < .05$.

The five discourse indicators were adopted to examine the students' high-level comprehension, "beyond a literal understanding" (Reninger & Wilkinson, 2010) and were compared between the students of the control and experimental group. The Mann-Whitney U test was adopted to examine AQ, TQ, and ET between the two groups. Whilst no significant differences were found in TQ and ET, a significant difference was found in AQ as shown in Table 6.

Table 6 Mann-Whitney U Test for AQ, TQ, and ET

	AQ	TQ	ET
M	0.18	0.06	0.05
SD	0.20	0.07	0.04
Mann-Whitney U	16.00	39.50	35.00
Wilcoxon W	71.00	84.50	80.00
Z	–2.38	–.46	–.832
Asymp. Sig. (1-tailed)	.008*	.333	.217

*$p < .05$.

Discussion

Literal Comprehension

The significant difference between the control and experimental group suggested that the students of the experimental group had better literal understanding than the students of the control group. This might be due to the fact that the students in the experimental group were required to always give supports to their claims during the group discussions. Therefore, they had to re-read the text and extract examples or information from the text in order to support their thoughts and ideas. By doing so, the students were able to demonstrate better literal comprehension (i.e., **be able to locate and recall**).

Example 1 below demonstrated how the students in the control and the experimental group performed very differently in response to the same discussion question: "**How does the author's father influence the author?**" (All examples were translated from Chinese to English. The Chinese of Example 1 was presented in Appendix 4) The students in the experimental group have adopted examples from the text or personal experience to support their ideas, such as Student 1's turn in line 5-8, whereas the students in the control group did not.

Example 1

[Control Group 2]

Q: How does the author's father influence the author?

1. Student 1: The author's father influence her by... by showing how to do.
2. Student 2: Learning by osmosis.
3. Student 3: Lead by examples.
4. Student 1: Yes! Learning by osmosis.

[Experimental Group 1]

5. Student 1: This is from their daily life... She saw her father go nowhere...
6. didn't go to work. She lived with her father every day... her father made her
7. breakfast... and kept her company. This was how her father gradually influence
8. her... Right?!
9. Student 2: Influence her exactly what?
10. Student 1: It is... I cannot tell specifically.
11. All students: [Laughing]
12. Student 3: I believe that (that) her father is her significant others... who had

13. great influence on her. A writer's child does not necessarily become a writer...
14. But when she observed her father writing every day... and I am wondering if
15. she would like to do the same job as her father.
16. Student 4: So, what you wanted to say was that... (inaudible)... (it was the)
17. process that made the author become interested in writing?
18. Student 3: Exactly! No matter Whether you are truly interested in one type of
19. job is another issue... When your parents or relatives were having the same
20. job, they were doing it every day... and then... it is possible that you want to be
21. in that position or job just like them... This is like a kind of imitation.
22. Student 4: So, just like a doctor family. All of the members in one family are all
23. doctors.
24. Student 3: You are right!
25. Student 1: Do you think her father... have her... expect her to become a writer?
26. Did her father do... train the author intentionally?
27. Student 4: I don't think her father do that on purpose.
28. Student 2: I agree... kind of let this happen naturally...
29. Student 3: I think maybe a little bit... because... because... her father brought her
30. to jail... and taught her writing with the prisoners. This event makes me think
31. that her father do (have some expectation for her daughter to become a writer.)
32. Student 2: From the author's description... her father may simply brought her
33. there without much expectation on that matter.

Example 1 further demonstrated how the students used language as a mean to learn, share knowledge, and reason problems together (Mercer, 2002). In this discussion, Student 1 of the experimental group first gave one's personal opinions on how the author's father influenced his daughter through his everyday behaviors, such as staying at home all day or always making breakfast for her in line 5–8, but Student 1's responses seemed unclear to Student 2 in line 9. Therefore, Student 3 further clarified Student 1's thoughts by proposing the idea of "significant other" in line 12–15. This idea was required to be clarified by Student 4 in line 16–17. Student 3 tried to explain more by making a connection to his personal experience, explaining how one will be influenced by the people around them, and concluding why the author would like to have the same job as her father in line 18–21. Student 4 agreed with Student 3's view point in line 22–23. In the discussion, students shared their ideas toward this question and they clarified doubts, developed logic, and tried to reach an agreement among members in the process of the discussion.

In contrast, the students in the control group did not provide any reason or explanation for their claims. There was no support for their statements and they completed their discussion within four turns and around 30 seconds. This example can be used to support that although a group discussion approach was theoretically effective for the students to share their ideas and knowledge and improve literal comprehension and high-level thinking (Rogoff, 2008; Wells, 1999), the students needed knowledge and training before discussions (Davies &

Meissel, 2015; Higham et al., 2014; Li et al., 2016; Li, Murphy, & Firetto, 2014; Mercer, 2002; Reninger & Wilkinson, 2010; Soter et al., 2008)

This finding to some extent challenged traditional style of lecturing, teachers giving detailed explanation or even translation, as indicated by the lower comprehension test scores of the control group. When the students learned how to conduct effective group discussions, were given responsibility to read texts, and were given more power over the discussion, they can learn more from the discussion processes. They not only understood the text content better, but also learned to share and supported their ideas. Therefore, it can be concluded that the QT discussion approach can possibly influence students' literal comprehension.

High-Level Comprehension

Having more AQs is very important for effective discussions and high-level comprehension (Li et al., 2016; Nystrand et al., 2003). Questions are viewed as "sites of interaction" (Nystrand et al., 2003; Wilkinson, Reninger, & Soter, 2010). When the students produced more AQs, it demonstrated their understanding and contribution to the interactions as shown in Example 2 below. Student 4 proposed a series of AQs (in line 6 and 8) to encourage Student 3 to provide more information related to what kind of writings Student 3 has involved in.

Example 2 [Experimental Group 1]

Q: What benefits can writing bring to a person?

1. Student 3: I thinking writing gives you a way of expressing one's... Ah
2. emotions. Before writing you may... you may notice nothing. But when you
3. need to write you will try to observe... this is a great way to release pressure.
4. Student 4: Have you tried to write? [AQ]
5. Student 3: Ah... Not very often... I will try another kind.
6. Student 4: Which kind? [AQ]
7. Student 3: Anything related to art... Writing is a type of art.
8. Student 4: Right...
9. Student 1: Is diary a type of writing? [AQ]
10. Student 3 and 4: Yes, I think so.

Among five discourse indicators, the use of AQs was significantly different between the control and the experimental group. Among five secondary question types (UQs, SQs, HLQs, AfQs, and CQs), it was found that the students in the experimental group used far more UQs (about double) than that of in the control group as shown in Table 7. UQs were follow-up questions that required individuals/respondents to give more information. The more use of UQs might suggest more interactions among the students during the group discussions. For example, two students asked two UQs (in line 5 and 8) in order to know more about Student 2's ideas on the independence (in line 1) as shown in Example 3.

Table 7 Numbers of Questions per Minute

Question types	Control group	Experimental group
Uptake	0.11	0.25
Speculation	0.00	0.04
High-level thinking	0.07	0.07
Affective	0.00	0.02
Connection	0.00	0.02

Example 3 [Experimental Group 3]

Q: What is the most important thing your parents teach you?

1. Student 2: I think... Independence. I have to decide a lot of things by myself.
2. My families are are busy... They don't have time... I was forced to be
3. independent. Just like... like going to school or cram school. I made decisions
4. by myself. Right, I decided on my college. Hahaha
5. Student 1: That sounds great. You were free and disciplined.
6. Student 2: I think choice... choosing colleges is the most important. I made
7. my own decisions. Right!
8. Student 3: Did your parents give you any suggestion? [UQ]
9. Student 2: That is... you should be responsible for your selection.
10. Student 3: It seems like...
11. Student 1: Do they support your decision? [UQ]
12. Student 2: Most of the time... But when I was absolutely sure of something...
13. they will show respect for my decision.

Except for AQs, no significant difference was found in other discourse indicators (i.e., TQ, ET, EE, and CT) between the control and the experimental group. This result did not necessarily suggest that the QT discussion approach was less helpful for high-level comprehension because the data of the present study included only discussions of Unit 3. It was possible that the students have learned to ask more AQs, but have yet mastered unfamiliar styles of communication (Davies & Meissel, 2015). For example, Exploratory Talk (ET) consisted of the students' challenges toward others' claims and followed by rebuttals in a dialogue. Both groups of students rarely used challenges in response to others' statements. It was thus speculated that the students were not yet familiar with "challenges" or "disputes". Example 4 below was a typical interactive pattern when the students were confronted with "challenges" or "disputes". Student 3 did not agree with Student 4's statement in line 5–8. However, when Student 2 expressed different opinions in line 9–10, Student 3 did not further explain one's ideas. This dialogue ended and the students continued with another discussion question. This short example demonstrated how Taiwanese students typically reacted to "challenges" or "disputes". Although a few challenges appeared, most of them were about different interpretations of the text (Example 4) or disagreement (Example 5).

Example 4 [Experimental Group 6]

Q: What is the most important thing the author's father teach her? Why?

1. Student 2: ... her father taught her...
2. Student 4: but he (student 4's father) taught me too mostly by example!
3. Student 2: the creative writing program...
4. Student 3: the answer lies in the third phrase.
5. Student 2: I think he taught her to read poetry and then be bold, be original, and... let ourselves
6. make mistakes. [challenge]
7. Student 1: It should be the last part on page 66. "... he helped the prisoners and me to discover
8. that we had a lot of feelings and observations and memories and dreams and opinions we
9. wanted to share..." Writing requires these qualities. Writing requires interactions with
10. oneself... To be able to observe and write them down.

Example 5 [Experimental Group 1]

Q: What qualities should a writer have?

1. Student 4: Appreciate being alone... emotional...
2. Student 3: If it is me... But why appreciation for being alone is important
3. quality for writers? If a group discussion over a writing task can also be part of
4. writing, too. [challenge]
5. Student 4: Right...
6. Student 2: Why do you think writers should appreciate being alone?
7. Student 4: Hmm... I think so because of the image of writers. They will usually
8. stay alone in a café... and observe others... and observe the environment, and
9. write their own stuff.

Furthermore, it was interesting to observe again Student 4's responses as shown in Example 5 above. Student 4 first proposed one's personal opinions toward the discussion question in line 1 and was refuted by Student 3 using one example in line 2–4. Although Student 4 can voluntarily further argued for one's personal opinions, one did not do so. Instead, Student 4 explained one's viewpoint only after when Student 2 asked a follow-up question. In this example, it seemed that a socio–cultural issue, facework (first proposed by Goffman, 1959), may cause student 4's reluctance to respond to the challenge. The construct of facework included maintaining one's and others' face during interactions. Taiwanese students were likely to avoid challenging others' ideas or opinions in order to save others' face and to remain silent when confronted with challenges in order to save theirs.

Because the challenges were not preferable styles of interaction for Taiwanese students, a typical interaction was that they tend to paraphrase others' idea in order to reach most possible agreement among members in the group. This was supported by more Cumulative Talk (CT) from both groups. In Example 6, Student 1 first pointed out that the author should be very observant and must have observed everything in her everyday lives, since her father was a writer in line 1–4. Student 2 and 3 paraphrased and extracted specific examples from the text to support Student 1's claim in line 5–6 and 7–9, respectively. Then, Student

3 made a conclusion based on the interactions. This was the typical interactive pattern, CT, in Taiwanese students' text-based group discussions. The different use of ET/CT discourse indicators found in the present study seemed to be the typical interactive style in Taiwanese students because such differences were not found in Davies and Meissel (2015) or Li et al. (2016).

Example 6 [Experimental Group 5]

Q: How does the author's father influence the author?

1. Student 1: Her father's job was a writer... so so she was also very observant.
2. She observed and learned from her father... when she was young. Also, her
3. father also taught her to live... experience everything in life. Write whatever
4. she wanted to.
5. Student 2: I think the influence was... was from the everyday life and... what
6. he had done. The author watched... lived... and learned from her father.
7. Student 3: This is more observational. The author observed whatever her
8. father did in everyday life. Her father got up early in the morning and did daily
9. routines. Was her father a writer?
10. Student 2: Yes. He taught writing in jail.
11. Student 3: Through the author's observation on her father's everyday behavior,
12. she had some thoughts on... and made some reflections... This is how the
13. author was influenced by her father.

Conclusion

There were two major findings based on the results of the present study. First, QT group discussion approach was an effective text-based discussion approach to facilitate students' literal comprehension compared with monologic lecturing style. After the students received discussion instructions, were given responsibility of text comprehension, and were given power over discussion, they showed a good understanding of the text (i.e., be able to **recall** and **integrate** text information). Therefore, it is suggested that teachers provide more chances for students to create dialogic interactions in class. Secondly, the students demonstrated high-level comprehension by using more authentic questions in the group discussions. Furthermore, it was also found that Taiwanese students consistently used more CT over ET possibly because the students felt that it was culturally inappropriate to challenge each other.

An inherent limitation was due to authentic classroom settings. In QT teaching approach, teachers participate in students' group discussion and play a role as facilitator. The researchers made a modification that the teacher took turns to participate in group discussions because of practical concerns without compromise with QT teaching principles. In QT teaching, teachers' participation in the group discussion should be gradually decreased and students have the ownership of text interpretation. Therefore, this partially explains why the researchers only use Unit 3 for data analysis.

The other limitation was relatively few test items. The researchers made such decision because of two concerns: time and aim of the test. First, two weeks to complete a QT discussion teaching procedure has been seriously discussed and decided to be the best plan in college contexts. Including more test items meant taking more time on comprehension tests, which may cause a delay of schedule. Second, the goal of the test was to ensure whether the students understood the main idea of the text instead of details.

Although this study provides a preliminary result on the effects of dialogic style on Taiwanese students' literal and high-level comprehension, it is interesting to explore whether students will acquire different styles of communication (e.g., EE or ET) when they have more time to practice QT. Moreover, since QT is a new discussion approach, it will be interesting to further explore how other factors possibly influence its effect, such as the language used during discussions, the number of participants in a group, teacher's engagement in the discussion, or types of text.

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Appendix 1

Examples for Six Question Types and Three Response Types

	Discourse element	Example
1	Authentic Question (AQ)	*Q: "What did you think was worse: the Titanic or the Edmund Fitzgerald? R: "I thought the Edmund Fitzgerald was worse because they went sailing when they were not supposed to. It was only a couple of years ago, so it should have been more advanced and prepared."*
1-1	Uptake Question (UQ)	*Q1: "What if Paul Revere failed his mission?" R1: "That would be really bad. Maybe... the British would take over..." Q2: "Would he be as popular?" (Uptake) R2: "No. I think we would be overruled by the British today though. It would not be too bad, like Britain today is not that bad. No one would like, tell us what to do. We just would not be as strong as a country."*
1-2	Speculation Question (SQ)	*Q: "What if the big horse did not get destroyed?" R1:"Then I think he would have been a lot happier."*
1-3	High-level thinking Question (HLQ) (Generalization and Analysis)	*Q: "How would you describe the Queen of the Sea?" R:"I think I would describe her as a nice, humble lady because her daughter was suffering, and she gave her what she needed to stay with her husband."*
1-4	Affective Question (AfQ)	*Q: "How would you feel if you were trying to solve the case in the story?" R:"I would feel a lot of pressure and stress because everybody would be looking at me, and usually, I do not do very well on stage because I have stage fright."*
1-5	Connection Question (CQ)	*Q: "What did you think of the talent show?" R: "It was good but kind of childish. I think our talent show had a lot more singing and stuff like that in it. We even had someone do baton."*
2	Test Question (TQ)	*Q: "What was their initial goal for inventing the machine?" R: "That they would get first place in the science fair."*
3	Responses	
3-1	Elaborated Explanations (EE)	*R: "I would probably feel pretty fortunate [claim] because my family was given the opportunity to go out west and start this new life [reason]. I would not think of the chores as boring. I would think of them as fun because of the space I had to do them in [reason]."*
3-2	Exploratory Talk (ET)	*Q: "Does Seeker of Knowledge remind you of Navajo Code Talkers? R1: "This story does remind me of Navajo Code Talkers because they are both codes. I mean, this one is on paper and it was hard for them to figure it out and the Navajo code talkers had to figure it out and stuff." R2: "I disagree, because in Navajo Code Talkers it's all about 29 men trying to figure out one code, and in this story, it is one man trying to make his dream come true about discovery. And in Code Talkers it's about 29 men trying to figure a code out so other people would not know what they are saying, and this is about one man trying to break the code, so people would know who he was. R1: "But it says in the story that there were many other people... like, scholars and Napoleon were also trying to figure it out."*
3-3	Cumulative Talk (CT)	*Q: "Why did Tony buy back his grandma's bracelet." R1: "Because he knew that his grandma was feeling really sick and that she missed her bracelet. He wanted to get it back for her so that she would not be as sad about being sick." R2: "Because she had had the bracelet for a long time." R3: "She had a lot of good memories of it, so it would help her not be so sad"*

Source: Murphy et al. (2017, pp. 2-4).

Appendix 2

Ten Questions for Group Discussion

1. How does the author's father influence the author? (HLQ)
2. What do you think of the author's personality? (HLQ)
3. What is the most important thing the author's father teach her? Why? (HLQ)
4. What benefits can writing bring to a person? (CQ)
5. What qualities should a writer have? (HLQ)
6. What qualities should a story teller have? (HLQ)
7. What qualities should parents have? (HLQ)
8. To what extent, do you think parents influence their children? (HLQ)
9. What is the most important thing your parents teach you? (CQ)
10. Have you thought about having the same job as your parents? Why? (CQ)

Appendix 3

Reading Comprehension for Unit 3

Unit 3 Bird by Bird 姓名________________學號______________

Choose the best answer for each question.

( ) 1. Which of the following statements is **CORRECT**?
A. The author's father enjoy teaching at the Prison.
B. The author and her father share common interests.
C. The author never figure out how to make her story telling interesting.
D. The author thought writing down ideas is not difficult.

( ) 2. What is **NOT** true about the author's father?
A. He has a nice office job.
B. He wakes up early every morning.
C. He enjoys writing a lot.
D. He cares a lot about his family.

( ) 3. What did the author's father **NOT** teach her about how to be a good writer?
A. To pay attention to our surroundings.
B. To start the habit of writing as early as possible.
C. To read books or plays that are consider great work.
D. To be bold and original.

( ) 4. Which one of the following is **NOT** the gift of being a writer as mentioned in the article?
A. To have the excuse to do things.
B. To go places and have chance to explore.
C. To pay close attention to the things happen around you.
D. To be funny and love to read.

( ) 5. What is **TRUE** about the author?
A. She hoped that her father could work at home.
B. She dislike writing because of fly in the ointment.
C. She was inspired to become a writer because of her father.
D. She decided to become a writer when she was young.

Answer the following questions with thesis statement and supports

1. After reading the story, why does the author choose to have the same job as her father?

____
____
____
____

2. You have read how the author's father influence the author to become a writer. Have your parents influenced you similarly or differently?

____
____
____
____

3. Do you think parents are children's best teachers in life? Why or why not?

____
____
____
____

Appendix 4

Example 1 in Chinese

[Control Group 2]

問題：你認為作者的父親如何影響作者？

1. Student 1：藉由親身實行，就是……親自……就是(就是)自己做然後……示範給作者看。
2. Student 2：耳濡目染。
3. Student 3：以身做則。
4. Student 1：對耳濡目染。

[Experimental Group 1]

5. Student 1：應該就是從日常生活中……就是他看到他父親都沒有去…就是出去
6. 上班。因為他每天都會看到他父親……幫他們做早餐什麼之類的…所以就逐漸
7. 影響到作者，這樣嗎？
8. Student 2：影響了他什麼啊？
9. Student 1：就是……我也不知道……
10. All students：哈哈呵呵！
11. Student 3：我覺得就是在……他就是在這種，就是他小時候的重要他人。帶給他
12. 的影響是非常巨大的，他不一定是從事作家這個行業，他可能每天看父親
13. 寫作，然後就是自己也會想要嘗試看看那種東西。
14. Student 4：所以就是你覺得他是這樣子的過程來引發他(inaudible)對自己寫作
15. 的那種興趣？
16. Student 3：對拉就是！不管有……你是不是真……就是……一定對它非常有熱忱。
17. 你看到父母都在從事那個行業，也不一定父母，反正就是你父親或母親其中
18. 一個，然後你每天看到他這樣……這樣做他的這樣的工作。你可能也會就模仿
19. ……這是一種模仿的行為。
20. Student 4：所以就有點像醫生世家阿那種。
21. Student 3：欸對！
22. Student 1：那你覺得就是他爸爸對他有……就是……也可以當作家的期望嗎？
23. 就是他爸爸有……就是刻意的要影響作者去……？
24. Student 4：我覺得沒有刻意耶。
25. Student 2：我覺得還好欸……有點順其自然的發展的感覺。
26. Student 3：是他爸爸也有……可是……把他跟那些就是……就是……在監獄裡面那些
27. 犯人，就是抓來跟他們一起教寫作文。我覺得還是有一點期望。
28. Student 2：感覺是帶著他去……就他的態度好像也不算到期望的感覺。

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研究論文

深度討論和高層次思考：台灣大學生之研究

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摘要

閱讀能力對於取得專業知識或是對於終身學習，是很重要的一項能力。多數的閱讀相關研究著重於讀者如何增進閱讀理解，較少研究著重於如何透過閱讀增進批判性思考能力。應用深度討論教學法（Quality Talk）之研究發現，此種教學法可以有效地促進閱讀理解和高層次思考能力。但是Quality Talk的相關研究中，學生皆以英文為母語，因此本研究探討Quality Talk對於非以英文為母語的學生之閱讀理解和批判性思考能力的影響。本研究將兩班的學生分成實驗組和控制組。控制組的學生接受一般的英文閱讀課程，實驗組的學生接受深度討論教學法的訓練課程。透過紙筆測驗和言談分析，評量兩班學生的閱讀理解和高層次思考能力。結果顯示實驗組學生獲得較好的閱讀理解，也展現高層次思考的能力。

關鍵詞：文本討論，言談分析，小組討論，閱讀理解，批判性思考

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JoEMLS 註釋（Notes）暨參考文獻（References）羅馬化英譯說明

2015年1月31日修訂

1. 本刊針對部分國外西文專業資料庫之引文索引建檔與中文辨讀之需求，凡屬中文稿件之英文摘錄末，特別增列中文羅馬化拼音之「註釋」（或「參考文獻」）一式。
2. 作者（含團體作者）、機構名稱（出版者）、地名（出版地）：依事實與習慣為英譯，如無法查證時，中國大陸地區作者以漢語拼音處理，台灣以威妥瑪拼音（Wade-Giles system）處理。
3. 出版品、篇名：採用（登載於原刊名、篇名等之正式英譯）照錄原則；若原刊文無英譯，則由本刊依漢語拼音音譯著錄之。
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4. 混用狀況：地名、機構、人名與其他事實描述，交錯共同構成篇名之一部分時，為避免冗長拼音難以辨讀，可將該名詞中之「地名、機構、人名」依事實與習慣英譯，其餘字詞則由本刊補以漢語拼音處理。
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   林信成、陳瑩潔、游忠諺，「Wiki協作系統應用於數位典藏之內容加值與知識匯集」，教育資料與圖書館學 43卷，3期（2006）：285-307。【Sinn-Cheng Lin, Ying-Chieh Chen, and Chung-Yen Yu, "Application of Wiki Collaboration System for Value Adding and Knowledge Aggregation in a Digital Archive Project," *Journal of Educational Media & Library Sciences 43*, no. 3 (2006): 285-307. (in Chinese)】
   範例2 －參考文獻（References）
   林雯瑤、邱炯友（2012）。教育資料與圖書館學四十年之書目計量分析。教育資料與圖書館學，*49*（3），297-314。【Lin, Wen-Yau Cathy, & Chiu, Jeong-Yeou (2012) A bibliometric study of the *Journal of Educational Media & Library Sciences,* 1970-2010. *Journal of Educational Media & Library Sciences*, *49*(3), 297-314. (in Chinese)】

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